Class BL240
Book .W5
Copyright No.

COPYRIGHT DEPOSIT.

NATURE IN THE WITNESS-BOX

NATURE
IN THE WITNESS-BOX

OR, SUGGESTIVE PARALLELS

BY
N. L. WILLET

PHILADELPHIA
Griffith and Rowland Press
MCMIII

BL240
.W5

THE LIBRARY OF CONGRESS.
Two Copies Received
JAN 5 1903
Copyright Entry
Dec. 10-1902
CLASS a XXc. No.
47916
COPY B.

Copyright 1902 by the
American Baptist Publication Society

Published January, 1903

YALE DIVINITY LIBRARY

From the Society's own Press

Th. v. G. May 16-31

This book is lovingly dedicated to the
memory of my father

Prof. Joseph Edgerton Willet, A. M., LL. D.

Teacher, Author, Scientist
Lover of Nature, and Lover of God

PREFACE

ALL kingdoms were made by God, and lie parallel. The laws and phenomena of one kingdom, therefore, must have their counterparts in the other kingdoms.

This great and ramifying Nature about us, visible and tangible and patent, was, I doubt not, meant by heaven to be for man a kindergarten school, wherein he might learn not only things earthly but also things heavenly.

This book is an attempt at the making plain of certain of Nature's laws and phenomena, and at the finding of their certain parallels in kingdoms that are higher. It is an attempt first, to increase our love for and knowledge of Nature herself, and then to make that love and knowledge concerning this which is visible serve as means for greater love and knowledge and faith in kingdoms that are invisible.

I beg to return my thanks for assistance in the final revision of the text to the well-known scientists, Profs. John B. De Motte and H. C. White.

NATHANIEL L. WILLET.

AUGUSTA, GA., December, 1902.

CONTENTS

		PAGE
I.	The Field of Force	1
II.	The Absolute and the Infinite	5
III.	Earth's Chaos	10
IV.	Earth's Awakening	14
V.	Carbon	19
VI.	Nature's Equilibrium	24
VII.	Where Earth's Trinity Meets	29
VIII.	Nature's Great and Small	34
IX.	Nature's Invisible and Hidden Things	38
X.	New Relationships in Nature	43
XI.	The Horizon	48
XII.	Landmarks	52
XIII.	Drift in Nature	56
XIV.	Paths	61
XV.	Oases "the Islands of the Blessed"	66
XVI.	Laboratory Methods	70
XVII.	The Media Through which we See	74
XVIII.	Frost	79
XIX.	Fogs	83
XX.	The Properties of Matter	88
XXI.	Stress and Strain	92
XXII.	Friction	96
XXIII.	Forms and Shapes	101
XXIV.	Lubricants, the Peacemakers	105
XXV.	Heat Conductors	109
XXVI.	The Center of Gravity	114

PAGE

XXVII. By-products Sometimes Called "Waste" 118
XXVIII. Overtones, or Fullness of Life . . . 122
XXIX. Things Homogeneous 127
XXX. Viscosity 131
XXXI. Radiation of Heat 136
XXXII. For the Protection of Life 140
XXXIII. Sediment 145
XXXIV. The Clinging Ones 150
XXXV. Chlorophyl 154
XXXVI. The Warping of Timber 158
XXXVII. Dormants 162
XXXVIII. Wings 166
XXXIX. Nature's Voices 171
XL. Compensation 175
XLI. Strength in Calmness 180
XLII. Barriers 184
XLIII. Bridging Chasms 189
XLIV. Is it a Clod? 193
XLV. Solvents 197
XLVI. Chemical Reagents 202
XLVII. Lost Motion 206
XLVIII. Resistance 211
XLIX. Nature's Varied Standpoints 215
L. Harmony 220

NATURE IN THE WITNESS-BOX

I

THE FIELD OF FORCE.

IN all parts of the country where certain rocks are disintegrating, down the little water-runs of the continuous streams, or the temporary ones made by rain, you will see among the sands millions of little black particles of iron. More often than not they are arranged in lines and figures according to the current and wavy line of the stream. Take an ordinary horseshoe magnet and run it through these dry sands, and the iron particles will adhere to it. These iron particles, or ordinary iron filings, afford us the means for a certain experiment, the phenomenon of which is most interesting and graphically wonderful. For if we sift these particles on a paper stretched on a frame, and hold the paper just above a horseshoe magnet, and then gently tap the paper, so as to overcome for the particles gravity and friction, we shall see our iron particles arrange themselves into the most re-

markable and beautiful curves. Not an iron particle within the magnet's range of influence but will arrange itself as a part of a beautiful elliptical line. There will be hundreds of these curved lines—called magnetic curves; and their total effect on the paper sheet, as a phenomenon, and with the magnet hidden, seems magical and almost beyond crediting. At any given point within the field its magnetic curve is the resultant of the magnetic forces at that point; and the directions of the varied curves are called lines of force.

Now there are millions of other particles of varied matter that one could set down in similar manner upon this our magnetic field; but the strongest magnet on earth could not move them by its force or influence into any curved or other line. Non-responsive they would stand like stocks. The intensity of magnetism of any given particle depends upon the strength of the magnet and the distance of the particle from it.

This whole earth is an immense magnetic field. Magnetize a needle and suspend it at any point on the earth's surface, and it will assume a certain position with reference to the earth's poles. Though pointing all to the same end, yet the dip or curve of no two needles will be just the same. And if you had myriads of magnetized needles on a plane surface of earth, you would see in their final adjust-

ments the same beautiful phenomenon that we saw on our sheet of paper. For, in truth, each bit of iron filing on the sheet was a tiny magnetized needle. This sheet of paper of ours was a minute picture of that grander effect that would result if magnetized needles were infinitely multiplied over all the plane surface of the earth. No needle would be out of line and every needle would be in some one of the lines of force that proceeded like rays of light from the earth's pole.

And yet think of the infinite mass of earth's matter particles that, inert and dead and uninfluenced, do not so much as know that the earth has magnetic poles, and that there are lines of force, and that they themselves are within the boundaries of a magnetic field. There are, indeed, even wide variations of magnetic susceptibility on the part of the various irons. Soft iron is more susceptible than cast iron, and fine steel more susceptible than other forms of iron.

This strange force that goes out so silently from the magnet hidden behind our paper sheet—force exerted so potently upon our iron filings—is constant and unwavering. And so is this seemingly still stranger force that proceeds from the poles of our earth. This force, of all the existent forces, has most the touch in it of the spiritual. It does not seem strange, therefore, and indeed it seems

the rather fitting, that this spirit-like force—though it is exerted so weakly that it could scarcely, from an earthly view, be called a force—should point out all the new pathways in the land, and should guide all the mariners on the unknown seas, and enable the lost and bewildered to discover, in a moment, their true relative positions.

Through the compass humanity has placed itself in the line with reference to our poles; and there could be no more beautiful magnetic curve than that one that points the guiding hand. But we may yet gain an intensity of magnetization undreamed of to-day; and in this wider magnetic field of force find a thousand new and unknown curves of beauty and usefulness, all of them radiating for our good, from the unseen magnet with its two distant poles, set by God in the foundations of earth.

The most powerful magnet in creation is not one whose poles are the ends of axes of either planet, sun, or star. The widest magnetic field of force is not the largest created material sphere. The whole creation is a magnetic field, and heaven is the magnet. From out of heaven lines of force proceed, like rays of light from the sun. The intensity of your magnetism depends upon how far from heaven you stand, and the fine or dull or in-

different quality of your spirit. Millions of human stocks and stones on earth feel no magnetic thrill, and individually become no part of any of these magnetic curves of infinite number that reach from heaven to earth and back again from earth to heaven.

The action of the individual iron particles on the sheet of paper in their final adjustment when rid of friction and their own inertia or weight and under magnetic influence, is typical of the actions of every God-loving man; for he, like they, must get into line, and the poles of his being must point heavenward. And on this magnetic field of earth the infinite magnetic curves, all of which were drawn by supreme artist-hands, what a phenomenon, beautiful even for God himself to look at, must be its Christians, each in line and with face turned toward Him!

II

THE ABSOLUTE AND THE INFINITE.

BSOLUTE zero ("absolute" meaning perfected, completed) is the most marvelous and in many respects incredible state or condition known to science; and yet a state scientifically true and correct. This is proven by a

Centigrade thermometer, whose scale markings begin at zero—the freezing point of water—and go upward to one hundred degrees—boiling water point—and beyond. Markings below zero may be made by the proportionate amount of decrease in a given volume of gas. Gas decreases its volume $\frac{1}{273}$ for each degree of heat withdrawn. If this volume, through heat reduction, is decreased thus two hundred and seventy-three times, gas would show no volume at all. There can be thus no markings below this. The marking at this point would show minus two hundred and seventy-three degrees (— 273 degrees) or — 460 degrees Fahrenheit thermometer. And this point two hundred and seventy-three degrees below zero point of Centigrade thermometer, and which is called absolute zero, is finality—the perfected, finished, completed, absolute! This is the lowest temperature which the nature of heat admits of; and since it is the motion of particles within a body that constitutes heat (the greater the agitation the greater the heat), then we can easily see that here at absolute zero there would be no agitation of particles; hence there would be absolute rest and naught but the quiet and stillness of the grave. This is the unthinkable region of negation. It is the hopeless realm of absolute despair. Science will never reach it; science indeed has as yet reached

no farther than about fifty degrees above absolute zero, and the freezing of hydrogen gas into a solid state, down in those deepest depths of cold, recently filled the world with amazement.

But think now! From this — 273 degrees' point on our Centigrade thermometer,—and where markings and thermometer all must stop, this negative, lifeless, without heat point,—from this point we can read upward till we reach the zero point; and then on and on and higher and higher and higher. Indeed and in truth we would never scientifically stop. Upward on our thermometer lies the highway of the infinite. And all along this way, from the standpoint of heat, is life, which is the agitation of particles. And the way too is full of beauty and marvels. At sundry and definite points all the various and solid metals, one by one, succumb and fall into liquid state; and farther on these liquid states are transformed into gases. (Think of two worlds crashing together in space and of a developed heat so great that both worlds would be changed into gas!) Above our absolute zero and on our thermometer scale science has gone upward only between three thousand five hundred to four thousand degrees Centigrade, or six thousand or seven thousand degrees Fahrenheit.

At this extreme high point, to-day science is melting clay and forming aluminum, and small

diamonds out of carbon and rubies and sapphires are there being made. Along in these temperatures the world itself was formed; mountains were thrown up, and depressions or hollows made for the seas. Melted gold and silver and tin and lead were run into crevices of the rocks, and all the army of crystals of glittering face and of diversified form and of beautiful color were made. It required these extreme temperatures, as I have said, for nature to form the world and fill it with metals and gems.

And, since heat is motion and temperature is measured by the rapidity of this motion, then what an infinite agitation and vibration of particles there must have been at the time of earth's formation! To-day thousands of horse power, conveyed as electricity over a copper wire, can be converted into heat between the two tips of carbon electrodes and there work wonders. Possibly in this great heat, and through this well-nigh infinite agitation of particles, all the precious gems may yet be turned out in a workshop as easily and rapidly as are to-day toys and baubles.

I do not know how much farther up this scale of the infinite—the scale of heat as marked by thermometers—man will go. Somehow I cannot help feeling that heat greater than six thousand or seven thousand degrees Fahrenheit, and which

from heat's stand-point is the greater life, has much to do with and must have relations with other cycles of our life in the great beyond.

Heat and love are correlated: take their every test and their every phenomenon and you will find this true. What one is in the physical world, so and such is the other in the world of spirit; and you could set up in this higher realm the same thermometer with the same marking. Deep down yonder must be theoretically absolute zero,—which would note the entire absence of love,—a region lifeless, hopeless, of stillness, and without agitation or vibration of particles.

In this hypothetical place, showing a theoretical marking of — 273 degrees, even God could not be, for God is love. Love's scale climbing ever and ever higher, reaches up into and is lost in the infinite. And all along love's scale is beauty and nobility and usefulness and heroism. Jesus has shown us somewhere, perhaps at the six thousand or seven thousand degrees Fahrenheit point, what the human being should be. If this degree of heat in the physical world forms a new earth and makes diamonds, rubies, and sapphires, then can six thousand degrees of love in the higher realm do less wonderful things? Beyond all peradventure 6,000 Fahrenheit of love-heat would form an earthly

paradise, and fill it too with such beauty as our dull eyes have never seen.

But there are still higher love markings than this—points now hidden and beyond our ken. So far as our vision can go, we have seen each new degree show individual phenomena; but what transcendent phenomena would ten thousand or fifteen thousand degrees of love-heat show? Heaven would be worth the seeking if for no other purpose than to see what love-heat has there wrought!

III

EARTH'S CHAOS

"IN the beginning was chaos." There are words that are too strange or too great or too sacred to be translated. Hence they are handed down bodily from one language to another in their unique and original form. The Greek word "chaos" is one of these. In the original its primary meaning is an empty infinite space, and secondarily it means an unorganized condition.

The scientific idea of the earliest creative days is that the whole of our solar and planetary system was in a state of vaporous fire mist. The earth was still a part of this mist. It had not

swung off into space as an elliptical body, and separate from the other planets. Therefore the Bible says that it was "without form." This vaporous, or perhaps gaseous, space was infinitely extended (as is the fashion of gases), and so thin was the medium or body, that the Bible graphically describes it as being "void." Granted that this original chaos was an empty infinite space and containing nothing organized, then it was impossible that in it could be any such things as what we may now call matter, or force, or method.

Now it is demonstrable that the earth, with its seventy-four or more elements, has gained or lost practically nothing since creation; and that all the matter therefore which we see about us, in water, atmosphere, rocks, or in the organized and living forms of animal and plant life, must necessarily have been in and contained in that vaporous space. And though this earth to-day teems with infinite structure and organism and method and law, yet we know there could not have been found one single cell (the unit of all organic structure).

What a faint idea we can have of that primeval condition! And since too, we never have a clear conception of the meaning of any word till we hear it in its original place, then no human mind can ever know to its fullest the true significance of our Greek word chaos. And it is certain that

since creative days we have had in the physical world no true exemplification of what chaos is. We go out into a neglected garden or field where crops are well-nigh obliterated with weeds and briers, or into a jungle teeming with miscellaneous wild plant life, and we call this place chaos, and this is as near as we can get to a modern exemplification, multiply examples as we will. But how unlike this chaos of the garden was earth's primal chaos, where no two atoms (the smallest divisible part of matter), though made for each other, stood side by side or even in relative position. If all the united minds of earth had witnessed the primeval scene, there would not have been in one the faintest hope that in that space where all correlated atoms had been driven as far apart as the infinite energy of heat could drive them, a hand some day would collect and would lay each kindred atom beside its fellow, and so cell by cell would build a world!

And yet out of that chaos, in very truth, grew even paradise. And the perfection of form in matter, and the perfection of all the highest and sweetest forces in nature, and the perfection of law and love and method and harmony—these were all to be found in paradise. And I shall not believe that this paradise, in which even God took a delight to walk every day, was of a narrow con-

tracted circumference down beside Euphrates' banks. God does not do things by halves or hundredths or millionths. It is easier to believe that this paradise of earth—typical of the paradise of heaven—filled all of earth, just as this later paradise is to fill all of heaven.

If, fresh from the hands of its Maker and in all of its beauty and perfection, this earth were given into Adam's hands for keeping and preserving, and if he failed in the doing thereof, and if here and there to-day there is to be seen semblance of the chaos of old, then it is not God's fault; go ask Adam! God with a wave of his hand did not simply substitute Eden for chaos. Chaos and Eden were antitheses; and they were so far apart that even God himself chose to take ages for the evolving of the one out of the other.

And no more striking example of antithesis is there in all the Bible than that in which Abraham, from the pure and ethereal heights of heaven, looked upon gross, sensual, and material Dives, and said, "Between us and you there is fixed a great chaos." It was Eden looking back upon the fire mist that was without form and void: for materialism, selfishness, sensualism—these are all chaos.

A man's mind is in a condition more or less of chaos according to the degree that he is build-

ing it up constructively, and according to method. Mental chaos would mean a mind without form or purpose, vacant and unorganized. God made men for heaven. The trend of man's life, constructively, should be toward heaven, as was the trend of ancient earth toward Eden. God has not left out of one single man the germ of a high and noble life. Every man has within him the elements and the power to turn away from or toward chaos.

I know that men, in times seemingly more than usually chaotic, despair of a future for humanity and government. But God sees possibilities where men see despair. From the beginning in ancient chaos God saw a possible Eden. Indeed, God must look at every man in the light of possibilities. And as he wrought chaos into paradise, how he must yearn that all men should likewise be builded up into their possibilities!

IV

EARTH'S AWAKENING

THERE was a time when this earth was a mass,—chaotic, inert, and unanimate. For neither as a fire mist nor as a molten earth glowing at white heat—seemingly a star to all other creations—was it possible for our earth

to contain cellular life. Nor was the time for organism yet upon it, even when the solid crust had formed; nor afterward, when the cooled atmosphere had condensed and had fallen in continuous rain torrents and so made the oceans and seas. Darkness was yet upon the deep. But as on some early spring morning after a dark and gloomy winter the sun rises, and in response to his vibrations—though far off—the brown and dead meadows turn into living green, the tree buds swell and burst into leaf, flowers bloom, streams break their icy cerements, and all the birds break into universal chorus—in some such way, the sun rose and flung his first rays upon this globe, and cleared forever its atmosphere of darkness. And in God's wise economy, the sun may have done more; the far-away vibrations of his atoms may have caused earth's atoms of carbon, hydrogen, and oxygen, to oscillate and form into groups (as a magnet forms beautiful pictures out of iron filings when under its influence), and thus perhaps earth's dull matter may have been first thrilled into organic life! When we consider some of the daily phenomena about us, it may not seem so strange that an atom on this earth should vibrate in response to another atom on another sphere with which it is in resonance. There is nothing more interesting in the

sciences of electricity and sound than that certain atoms do electrify and incite into action other and distant atoms. Those distant and attenuated voice-sounds that you hear—two or three at a time—are currents from other wires that at no point touch your own telephone wire. Of all the thousands of incandescent lights in your city, there is not one whose wires lead back into any electro-dynamo or other source of power. This lighting is done solely by means of an induced current made by its own wires being placed near other and live wires. And because atoms, in certain live wires, incite into activity atoms in contiguous dead wires, hence the costly insulation of wires.

Various other phenomena, similar to the foregoing in electricity, are akin to phenomena which we find in the matter of sound. I uttered a certain note in our music-room the other day, and the damper in my Calcutta self-feeder moved in its socket and turned the stove's heat on. Piano players know how often a certain note on the piano causes the gas globes or other similar things in the room to rattle and sing. I have often heard an organ note cause a church window of two hundred pounds weight to vibrate so violently that there was danger that the window would be broken.

Every pianist knows that the various strings in a piano are not solely to produce many distinct and separate musical notes. He knows that if he strikes one key the sound that he hears comes not from that one note, but that he hears the tones from octave strings and over-tones of the twelfths and fifteenths, etc. The piano as an instrument, as well as other musical instruments, would be of trifling value if dead strings did not awaken into sympathetic life and sing in harmony with the one note struck.

There is still another added strange phenomenon to be seen in sound. Hold a vibrating tuning-fork over a glass partly filled with water, and when the air in the glass is in resonance with the fork, the glass and fork will both sing ; but the tone of the fork will become greatly reinforced and augmented. All of these things go to show that even in dull matter about us one atom in action may arouse other atoms into similar action ; and that all parts of this universe may be correlated. Even in dull matter we find that no atom can live to itself, and no atom can die to (or separate) itself.

There are those about us who are psychically magnetic. They have the power to gather friends to themselves, and they have the good power to influence and sway others. One can almost see

the atoms of their lives in vibration, and can almost see the induced and responsive and unison vibrations in the lives of others. Such a man stands in analogous relations to the vibrating live wire that begets an induced current in other wires that light up a thousand lamps. He is the vibrating note in the piano, that induces a multitude of other notes to sound. We have a similar effect when at the end of an exquisite and thrilling solo a great chorus catches the singer's vibrations and responds in mighty refrain. No man who does not himself vibrate with thought or feeling or love or action, and who thus has no power to induce similar motion in others, need ever stand in pulpit, or on forum, or attempt to lead an army or a host into any undertaking.

Think you it is strange that God's notes of love that have been sounding in human ears for thousands of years should not meet certain response? Is it strange that humanity should thus thrill into life and into love and into action? If the water in the glass is not of just the right height, the glass will not sing in response to the tuning fork. Is there not thus an obligation resting upon us to put ourselves into such relations to God—in other words, to put ourselves in tune with the infinite God, so that our lives will vibrate with his life, and so that we shall think

his thoughts and do his works! In this way our poor lives will be lifted up and glorified; and as the sound of the tuning fork is augmented in some such way, so shall the vibrations of our lives give added glory and power even to the infinite One!

The word heaven means harmony; and hell is an old English word meaning to surround one's self with a wall, to separate one's self. Think, then, of God's thoughts and words far up in the highest, inducing responsive notes in the thirds and fifths and octaves and twelfths and fifteenths and thirty-seconds—think of all life in heaven vibrating in harmonious and swelling chorus to God's every thought! He who walls himself in, and who separates himself so that no vibration of his shall ever reach others in helpfulness, and to whom no vibration of others shall ever penetrate and so arouse into action, is already in hell.

V

CARBON

THE organic bodies of animals and plants formed the crowning point of creation's evolution. As an aggregation of gaseous matter infinitely extended, as a fluid mass, or lastly as a sphere composed and made up of inanimate

matter, the earth in all of these states was matter without life—was dead.

But a new era has come. There now appear organic bodies—artificial structures consisting of parts with a common life and mutually dependent and having functions, each of which is essential to the existence of the whole. Concurrent with organic bodies we find a new elementary substance hitherto unknown: not earthy, not stone, not metallic, and yet it is confounded with all of these. Its name is carbon.

Carbon is the foundation of creation's organized structures. Reduce the body, in the absence of air, of any animal or plant by fire in a crucible to its last reduction, and you arrive at the element carbon. The animal or vegetable body in its last analysis is carbon. When God, in the latter days, entered upon the creation of organic structure, he necessarily took first carbon. Carbon was a prime necessity for the creation of all of these higher forms that contain life.

Chemically pure carbon possesses these characteristic qualities. It is odorless and tasteless; it is infusible and eternally changeless so far as further reduction is concerned, and it is therefore indestructible. It cannot be acted upon by acid or other reagents or solvents. What beautiful qualities these are! How they place carbon at

once in the highest places, and as a changeless, eternal thing among the immortals!

The diamond, the hardest of all substances, and with faces as bright as shining planets, is composed of carbon in a crystallized state. Diamond remains unchanged in hydrogen gas, no matter how great heat may be applied; but placed between the carbon poles of an electric battery it swells up and is converted into a black mass of graphite.

Graphite, formed in lumps in crystalline rock formations, is another modification of carbon. It is steel-gray in color, oily to the touch, and is used in making cedar pencils, crucibles, preventing rust on iron, and in the lessening of friction.

Charcoal and lampblack contain carbon, though mostly in a largely impure state. Gas carbon, found as a hard gray mass in the upper portion of gas retorts, is one of the purest forms of charcoal. Possibly the most pure form is charcoal made from white sugar heated in a platinum basin. The charcoal of commerce is made by placing wood on end and covering it with earth so as to prevent too free combustion. Holes at the bottom and top of the earth and a space up the middle of the wood are left. The wood is then set on fire and allowed to burn just enough to drive off all gaseous matter. The earthen covering is then removed.

Mining coal is an impure carbon. It is formed wherever vegetation decays in the earth in the absence of air. Coke is the residue of bituminous coal heated to redness in the absence of air. It gives a high temperature and no smoke, and is used in iron smelting. Animal charcoal, or bone-black, made by charring bones in an iron cylinder, is used in chemistry as the best means of clarifying the more costly yet impure substances. If red wine is run through bone-black it comes out colorless. Alcohol filtered through it loses all of its fusil oil odor. Bone-black (as well as wood charcoal) absorbs unpleasant odors. It not only absorbs the odors, but it oxidizes and actually destroys them. For this purpose trays of heated charcoal are frequently placed in hospital wards. In most filtering plants charcoal is the main constituent.

Now when we unite carbon with other substances we enter upon an infinite field for study. The class known as the hydro-carbons is especially interesting,—the simplest, best-known illustration being illuminating gas, which is made by uniting carbon and hydrogen.

In thought the world may have always placed carbon among the very lowly things. And yet, as we have seen, in its simple form and in its combinations it gives to the world heat, light,

beauty, and priceless worth. Carbon in every case is the primal indestructible base or foundation upon which all organized structures in the greatest of God's earthly kingdoms stand. What a value has God thus placed upon it!

Truth is the carbon of the moral world.

Without truth there cannot be any life whatsoever in the moral world. Imagine a world in which truth has never entered! When truth enters into a man a living creature is made, and God and angels rejoice as much thereat as Creation rejoiced over Adam's birth. Take your business, your profession, your daily work, or study, or word, or thought, and combine it with truth, and life at once becomes the bright and loving thing, the beautiful thing, the royally rich thing, that God meant it to be. Truth is the basis of the moral life. The moral life can have no other foundation. Truth is indestructible. It cannot be attacked and destroyed. Fire cannot burn it. Acid cannot eat it, nor can any solvent cause its dissolution.

The Bible tells of a new earth. Carbon will surely be there, for carbon cannot be destroyed. It tells of a new heaven; truth will surely be there, for truth cannot be destroyed. The most recent science demonstrates as a fact that the sun

is surrounded with a complete envelope of carbon. Even the inconceivable fires of this great luminary cannot destroy this carbon envelope. In some such way God has wrapped truth about this universe. The fires of hell will not prevail against it. That timid soul fearing that truth will perish from the face of the earth, has little conception of the absolute indestructible quality of truth.

If carbon, which is the chief constituent of the organized bodies, differentiates these bodies from clods and stones, then it is truth that differentiates some men from other men, and differentiates too, angels from demons.

VI

NATURE'S EQUILIBRIUM

UT in the grass and sedge fields there is a certain pathos and sadness in the fading out of the living green into the sere and yellow. But nature knows how to fit and suit her changes to new conditions. In nature the one thing is always the complement of the other. The bark, the leaf, the flower and the fruit of every bush, plant, or tree all bear colors each of which is complementary to the others. No harlequin is ever born or evolved out of nature.

And so it is if we should look out in a January freezing northeaster and see only green verdure on all sides, that we would doubly shiver as we thought of the living grass or leaves so sorely beset and encompassed by the cruel emissaries of the snow or ice king. It is more comfortable to look out in the storm upon hedges that are yellow and brown; and we say to ourselves then of the cold winter's storm, "It cannot now hurt them." And we say to ourselves too, as we hear in midwinter the creaking of the heavily laden limbs of the trees, and hear the cracking and crashing of the falling ice that erstwhile encased them, "I am glad that the summer leaves are not there."

And as I look out upon a snowy world and hear no cheery bird songs, I am glad then that nature gave her feathered tribes that strange sense of migration that sends them southward betimes into balmy and sunny climes. And my heart—and my bread crumbs too—go out in the snowy storm to the bright-eyed, wee bit of fluffiness unfortunately belonging to the can't-get-aways, that I know must be frozen to his very marrow bones. I am glad there is a southland somewhere for all the birds, and at the first voice or touch of winter I would be the first to urge them thither, to hie away and begone, even though it did take, for me, all the songs out of the trees. When I see the

ground all hid with snow, then I am not sorry that all the birds are gone.

Just what all the furry tribes, for which nature must prepare warm beds, would do if grass remained green all the year I do not know.

The dried and bent-over grasses in all the fields to-day look as if they all were warming and sheltering some hidden animal life. A rabbit never has, at any other time, half so good and warm a bed as he has in December or January. With my dogs I have routed many a cotton-tail on a frosty morning out of his burrow, and have allowed him unpursued to run affrighted out of my sight, while I stayed behind to marvel at the snug-fitting and warm bed that he had left behind. And many a winter's day have I lain by the half-hour deep hidden in the thick and tall brown broom sedges, as sheltered and as comfortably warm as if blanket-wrapped.

And so careful is nature to suit all life to changed conditions, and to make constantly a harmonious whole, and to keep all things in a state of safe and continuous equilibrium, that she even changes in mid-winter the color of the hair upon the backs of our furry friends; and she puts to sleep, at a time when food would be hard to get, her large family of dormants.

Nature, more than you and I and all others,

understands the true relation of all things. Nature is using on this earth a million balance-wheels to keep these relationships steady and true. The natural life about us seems but one constant kaleidoscope of color and form, yet they smoothly merge the one into the other and fit like tongue and groove.

If nature did not watch and know relationships, if she allowed, for example, winter to rush through creation like an express train, and if she did not previously send the birds and many fishes into a safe and far distance, or if she did not put certain slow-footed dormants to sleep in sheltered nooks and crannies, then just what would happen, tell me, to a large part of animal life? In all the seasons and times we find new but harmonious equilibriums, for nature's balance-wheels are ever turning.

Man's history is the story of the actions of human beings who are adjusting themselves in some way or other to changed environments and conditions. We all daily adjust ourselves to new issues, and to that new view which the diurnal change of the kaleidoscope presents. We are constantly endeavoring to maintain a certain kind of harmony or fitness or equilibrium. Not to do this would soon leave us as forlorn and wretched

as is the poor bird in snowy midwinter, that did not know enough at the proper time to fly away (and ahead of the cold) to the southland. That man who does not fit tongue and groove to his environment, and is out of sympathy and out of mind and heart with the times and with all about him, is as lonely as would be a green leaf on the ice-encased branch of an oak tree in January.

Strike your tuning fork, O doubting man, upon this terrestrial crust, and listen in all the varied stages of earth's evolution; first a fiery mist, then a molten ball, then the congealing of a thin crust, then the formation and separation of continents and seas, and then the laying therein of the foundations of life whose variety and numbers to-day no one can conceive. Do you not hear a constantly ascending note—a note that is ever finer and sweeter and more ethereal? God during all of the ages has been fitting the world to new uses. And life on earth, animate and inanimate, has been all the while in a constant state of transition in order to suit earth's changed conditions.

If the march of time, in planet, has had an upward and onward trend and a constant ascending note, I do not doubt but that star and heaven and life upon and in them, in harmony with God's abiding thought concerning them, have gone onward in the same or greater ratio of change and

advancement. But always there have been adaptation and adjustment and equilibrium. You and I are not fit to-day even for the life of ten years hence. You and I are not fit to-day for the life of other planet or sphere. But if God cares for the birds and sends them southward, if he cares for the dormants and puts them to sleep, if he adapts the brown dried grasses in midwinter to suit the needs of the four-footed can't-get-aways, and even changes to warmer colors the fur of their pelts, then will he not by as much more, keep you, O man, and keep you too in constant equilibrium with those changed conditions that must constantly and forever arise in the great beyond?

VII

WHERE EARTH'S TRINITY MEETS

WHENEVER blind force meets blind force there is apt to be the clash and crash of opposing forces. I do not always so find it down here at the sea's side, where three great kingdoms, earth's trinity,—the land, sea, and sky, —meet and mingle. Even more so than with the land does the sky, meeting the sea, melt lovingly into it. Though to-day is fair, and though it is clear landward, it is just a bit hazy off at sea, and

at no great way from shore the sky and sea seem to meet, the horizon is almost blotted out, and I scarcely know whether that tiny boat out there is sailing in the sea or through a tinted sky. At night the line of demarcation is still more dim, and many a night at sea I have spent hours with the lookout in peering into the no great distance ahead trying to find the horizon line, and perchance to see some black object outlined against the whiter sky. And for whole days at sea I have seen the sky and sea locked fast in an embrace, and have sailed thus through fog so thick that the tops of our masts were invisible.

And so it is that sky and sea seem faster friends than land and sky. Who can tell of the mist out there, if it be the mists of the sea rising to meet the sky, or the mists of the sky falling to meet the sea. And stranger than all of this is the fact, that all day long by the sun and all night long by the moon, the sky, like some great artist brooding over wide worlds, is tracing and penciling lines across, and is painting in ten thousand varying tints and colors the surface of the sea. From generation to generation, from cycle to cycle, these two great kingdoms have lived like lovers; now rising on the one part and now falling on the second part to embrace and kiss. And when on clearer days they withdraw, who shall say which

of the two is the more loving and true—the overhanging one with heavenly brush painting the surface of the other with beauteous colors, or the sea that knows no greater tribute to pay to her sky-lover than simply to reflect from her own face the beauties that she sees in the concave above?

In some such loving, gentle way do also the land and sea meet, the sky bending over all. Forty miles or more from the coast, as you approach the sea, you observe evidences of a change. The pine gives way to cypress and bay; the soil looks darker; the rivers too are black and sluggish; we find no more hills, but in their place is a level plain cut into by frequent bayous and swamps and marshes. All attempt of cultivation of the land soon ceases—the only growth being marsh-grass and myrtle bushes. In all the water-runs we see evidences of the last high tide. Now and then in the freshening breeze we get a whiff of salt in the air. On all sides we begin to note the encroachments of the sea, but so gently does the land blend into the sea, and the sea into the land, that we look in vain for some line of demarcation.

Our train passes through a clump of stunted, battered live oaks, and rounding a curve there in plain sight lies a wide stretch of white sands, with the blue sea beyond! In all of Christendom there is no more debatable territory than these same

white sands. Cast up ashore originally out of the depths of the sea, tossed hither and thither by winds, covered half of the time by ocean's waters, and appearing for the other half to be veritably a part and portion of the land, it would seem that land and sea without legal controversy as to true possessive rights had decided simply in truest equity to divide time; and so it is that for twelve hours out of twenty-four these sands belong to the realm of the sea, and for twelve hours they are a part of the dominion of the land. One would look in vain for a more fair and more loving concession and yielding, the one to the other.

Crossing the sands and encountering the sea, we find notwithstanding the burly, good-natured roar of the bar that this great ocean in its actual contact with the land is so shallow and so gentle in its ways that a child's feet can safely wade therein.

Sometimes it would appear as if the one realm had indeed invaded and had stolen goods from the other, but more truthfully it would seem that it had been a matter of mere gleeful playfulness, for I never saw the sea carry a log from the shore but that it left behind and in its place a whole heap of pearly shells!

Not more strange and curious are the phenomena that we find in the easy gradations leading out of

the one kingdom of this great trinity into another than in the change or transformation that takes place here in animal life. To the birds that we find on the beaches have as a rule been given either long legs for wading or web feet for swimming. And that great host of other animals, crabs, oysters, turtles, scallops, clams, fiddlers, and many more besides—it seems (so fitted are they for both conditions) to make but little moment to these whether they are high and dry on land, or are, on the other hand, submerged under the waters of the sea.

Not more easily do the seasons fade, the one into the other, or night into day and day into night, than does the land fade into the sea and the sea into the sky, or the reverse. There seems to be nowhere contention, nowhere a clash and a clatter and a call to arms between the powerful forces of earth's trinity, but the rather, like lovers three, hand in hand, united and undivided they go to make up earth's beauty and shapeliness and fruitfulness.

Like an iceberg at sea, cold and chilling and crushing anon into the great world's sailing craft or into other fellow-icebergs, do some people meet and jostle and overwhelm their fellow-brother man. They make no concessions to him. They do

not meet him ever half-way, and they never give and take. They do not recognize any neutral or debatable ground. Not so the man, who himself a part of a great trinity—part human, part divine, part earth—blends into and goes hand in hand with the other two kingdoms about him, or the individuals thereof. Blessed on earth among men is he, around and about whom is the equivalent of the beach by the sea—an area filled with gentle ways and many concessions and much good-will.

If Christ had never come into the world and become human, and thus by this easy gradation had blended, for man, heaven into earth and earth into heaven—if God that day on Ararat's summit had given there his last message to the world and had gone back to heaven there to await the final coming to him of mankind—how different then would life and the future seem to you and me!

VIII

NATURE'S GREAT AND SMALL

GO throughout nature and find me, if you can, one thing that could claim superiority over its fellows. The world to-day could not decide as to which is the fairest flower, the most delectable fruit, the most charming land-

scape, or the handsomest shrub or tree; nor could nature herself decide the matter. The infinite number of created material things is not half so wonderful as the infinite variety in form, color, and quantity. Nature never made two things that you might set up, side by side, in comparison. Neither from a scientific nor an artistic standpoint is the granite mountain any greater than is the humble lichen that clings to its side. They are in truth made different in order that you might not compare them. Consider if you will the immensity of the Atlantic and all of the life therein. Yet if you will let water, in which dead plants have been placed, stand for a week in an aquarium the aquarium will be filled with just as much active and disporting life as is yonder sea full of fishes. One drop of water filled with animalculæ, under a microscope, becomes a veritable sea! Take from out of that drop of water one single germ, and make it the source and fountain head of a bubonic plague, or a yellow fever scourge, and would not that drop of water seem as full of potency as is the sea with all of its monsters?

The blooming magnolia forests of South Georgia, the great stretches of tree-like oleanders on our coast islands, the blooming orange or lemon groves of Florida, the apple orchards in spring in

New England, the luxuriant poppy and tulip farms of Holland, the mountain tops of Switzerland covered in summer time with Alpine roses or daisies—as we wander through each in turn, we say: "This surely is the best.". But is "the best" any better after all than is the humble violet bed at our door, that smiles up at us as we pass or breathes out to us its perfume by way of welcome?

The South brings her cotton, the Middle States their corn, the West her wheat, New England her potatoes, Japan her rice, France her vines, and China her silk, and each one says: "Lo! mine is king!" But there is no king. Nature made the material things of creation, each one a unit. She endowed each with an individuality and a singularity all its own. Each thing was to have its own place in nature's economy. So far as we know, each one was as necessary as the other. And in growth nature tries as hard to develop a little umbrella tree as she does a hundred foot poplar or pine.

The rock for a pave, the wood for our house, the coal for fuel, the wheat for bread, the peach for fruit, the grape for wine, the rose for sweetness, the snow and the lily for purity, the water for drink, the grass for the world's green carpet—with each as necessary as the other, who shall say which is the greatest? Yonder mountain or for-

est with all their size and bigness, would have gladly exchanged places, the one with the little stone that from David's sling slew Goliath, and the other with one of the palm branches that lay in Jesus' path as he entered Jerusalem.

There shall come a day in the further development of the telephone and the telescope when we shall no more use the term "distance." It is only ignorance that in nature's domain ever uses the terms "great and small." Each precious bit or portion of material life was made by nature for a specific and for a wise purpose; and in nature's heart I am sure there is no first and no last and no last and no first!

Between men, each of whom is fulfilling his mission in life, there can be no comparison made. Each, because he is filling his place, is carrying out God's plan. Angels do no more. If, therefore, one should despise his neighbor or look haughtily down upon him, or by any means exalt himself in his presence, and if perchance that neighbor were carrying out in his life God's mind and purpose—just what would be God's thought of him? If we who are trying so hard to fill our barns and our private safety vaults with material things (as the savage would gather together beads and brass trinkets), and if we should use these

material things (never meant for comparisons) as an index to point how high up in the scale of life we are and above our fellows, just what would be God's thoughts of us? And because it is a law in the kingdom of spirit that "Whoever of you will be chiefest shall be servant of all," then if we should fail to realize that we are to-day living in the kingdom of spirit and not in the fleshly and material kingdom, and that we are bound by all its laws, and if we should erect barriers about ourselves or set ourselves on pinnacles, then just what would be God's thoughts about us?

Does heaven seem any the less heaven to you because there will be no material objects up there possessing size or proportion or value or strength by which you can measure your worth, and so designate for yourself some high place among your fellows?

IX

NATURE'S INVISIBLE AND HIDDEN THINGS

THE world is apt to look upon nature as being manifestations put wholly and only into material forms. These forms all have shape with length and breadth and thickness; they all have weight and are visible. We

see them and touch them and feel them. They appeal to some or all of our various senses. They may have beauty or otherwise; they are rough or smooth; large or small; hot or cold; they may be heavy or light, or sweet or sour. We can divide them. We can analyze them. We can put them into crucibles and burn them. Acids will eat them up. By many and varied tangible means we know that they all have an individual entity. If you were to attempt to deny this your various senses would rise up and demand of you the truth.

But nature in her realm has her intangible, her imponderable, her invisible, and her occult things. We know of these things only through their effects. As to the things themselves, so far as our senses are concerned, they are matters of faith.

As wide as is the earth itself is the field of terrestrial magnetism. The fact of its existence is shown by the individual dip of the needle at any and every point on the globe. Indeed, these electric currents in the earth's crust are so great, especially during periods of sun-spots, sun-storms, and of the Aurora Borealis, that they render telegraphing signally unintelligible. Yet there could be nothing farther from the material than is this magnetic field of force. What, indeed, is there tangible and visible in the whole question of magnetism? You might magnetize your knife blade

so that it would attract a needle, or an iron or steel nail, but you would have added nothing to the weight or appearance of your blade. The added force you gave to it could not be determined by any means except through the effect of this force. And by and by, when your knife blade gradually loses its magnetic powers, no known science by mere examination of the blade could discover any loss whatever.

Now the same is true of electricity. No one has ever seen electricity. You send one or four or eight telegraphic messages over the same wire at the same time, and yet no earthly power could discover any material difference in the wire when carrying one message or eight messages, or for that matter no message at all. The electric generator would show no material difference when it is alive with electricity and able to turn the machinery of a cotton mill than when it is nothing but a coil of inert wire. The miles and miles of feed wires through which at night runs the current that thrills a thousand arc lights that illumine a city, these wires, by every physical test known, would show no visible difference at night or by day.

No force of earth is more universal than is gravitation. There is not a single terrestrial object that does not possess this attractive force for

all other objects. The most common of all phenomena is that of a falling body. Yet so imponderable is this force that the world existed many thousands of years without knowing of its existence. It was only in 1687 that Sir Isaac Newton, arguing from effect to cause, first demonstrated the law of the attraction of gravitation.

If it were not for affinity—that attraction that an atom has for another atom—there would be no such thing on this globe as a structural unit of any kind. If it were not for cohesion to bind together these structural units, then there would be likewise no such thing as homogeneous bodies. And yet who ever saw or handled either of these twin forces? How do we know of their existence except that we see the effect of these forces in the building of the unit and the body?

And while this force called affinity attracts certain atoms, there is also another force that repels atoms. Atoms under its influence fly apart, and yet what proof have we of the existence of this force except in the effects as seen by us?

The man, therefore, who in nature's realm would not recognize the existence of anything not perceived by his own senses would be an agnostic or an unbeliever in many of the most tremendous matters of this realm.

Aside from all of the forces related above, what is there more intangible, imponderable, and mysterious than are life and growth? These too are forces, the grandest and strongest to be found in the kingdom of animals and plants, but what bodily sense could possibly take cognizance of either except by their effects? Is God or heaven any less real because we do not see them, or because our varied senses do not in anywise recognize them? And for similar reasons are the operations of his Spirit, and is the work of the angelic spirits in this world any the less credible?

Shall we be allowed to argue from effect to cause in the natural world, and yet not be allowed to do this in the spiritual world? Shall you be forbidden to argue back from this great world of material and created things to its Creator? And if ten thousand peoples about you show plainest evidence of a force that has uplifted and glorified their lives, shall you be forbidden to see in these things the work of the great Redeemer of mankind? Shall you or I be an agnostic because we cannot understand things found in the spiritual realm? Has any one yet ever understood magnetism, and why the needle hangs to my magnetized knife blade? And yet is there any man who is wise who to-day is an unbeliever in, or a skeptic with reference to, magnetism?

It requires some degree of faith on our part to believe that a telegram comes really from the supposed author. Who ever sees a message come or go, or sees it in transit? God who has given us ten thousand evidences—and daily multiplying—and who is demanding of us, with reference to himself, unshaken and substantial faith, is not asking a thing that is unusual or strange or occult or hard!

X

NEW RELATIONSHIPS IN NATURE

IN Germany, so I am told by a native, it is usual for mothers to bathe their babies and little children in spinach water. A German, who underwent this *régime* for ten years of his child-life, told me that the effects of this queer bath are startlingly invigorating and soothing. This reveals a strange and unthought-of relationship between spinach and babies. In the matter of exploiting new relationships between plant life and the human, Germany gives us further example. In no other country, perhaps, are plants which are designated as weeds, such as dandelion, dock, charlock, pig-weed, purslane, etc., so largely used as foods. And it is no small matter to take a plant out of the class or order of

weeds and place it in the category of foods, and so give it a new relationship to man, and one that it had never before borne.

It is apparent that the moment any one thing takes another and double station in life and assumes a new relationship, it becomes thereby doubly useful and valuable. If a cornstalk with its ear had been made simply for standing up straight and looking handsome, life for it would have been simple enough. But since it can be made into meal, and some of it goes to the chickens and cows, and some of it goes into muffins and corn cakes or into hominy, or since it can be given whole as food for horses and hogs, or since it can be pressed into corn oil, or since it can be put into vats to come out corn whisky, high wines, or alcohol, or since it can be made into starch or dextrine or glucose, why at the end of its row of possibilities corn becomes an exceedingly complex affair. But go farther and make a sub-division : take alcohol, and since alcohol may be used as the menstruum that keeps and preserves the medicinal elements found in our tinctures, fluid extracts, tonics or patent medicines, or since it can be used in the manufacture of smokeless powder, why we see that corn has become a still more complex affair. Corn, in the form of smokeless powder, to-day hastens the rise and fall of nations and

stands in a relationship even to great governments never dreamt of a few years ago.

As complex as corn is our Southern cotton seed. Its linters, hulls, cake, crude and refined oil, with each of their subdivisions and possibilities, place the parent seed on continual new ground and give to it new relationships as complex and ramifying as is a family tree.

Scarcely a month goes by that some new product out of common coal-tar does not place this crude, black, rough product in a new relationship toward the medical and dyeing world. There was a time when the world believed that the only relationship between the lightning and human beings was as a fiery, destructive dart, hurled from Jove's hand upon the heads of his enemies. But so radically different in effect is electricity when applied to electric cars, or to lighting or heating, or telegraphing or cabling or telephoning, or in vitascope work, that it would be well-nigh impossible to prove to an ancient Roman or Greek that these seeming different forces were after all nothing but lightning in new and varied relationships.

It took the farmers of the South one hundred years to find out that there was any relationship between the phosphate beds of South Carolina, Florida, and Tennessee and their crops of corn and cotton and wheat. Yet the man who exploited

that relationship did greater service to the South, and indeed to North America and to Europe, than if he had discovered gold mines in place of phosphate beds.

These illustrations prove that there are going on in the physical world continual developments that place objects in absolutely new positions and places. Equally true is it that no sooner does the object assume a new position than must all related objects treat it as if it were a new creation.

The world is just finding out the infinite uses of material nature. And each new discovered use brings the world into one or more new relationships, and brings too, a new-found joy, and above all a new obligation. That man in the material world is the most learned and wise who has discovered the greatest number of relationships to himself and *vice versa;* and that man of all others is most ignorant whose life recognizes and comprehends the fewest number of these relationships. The benefactors of the world are those who, digging and delving in the twilight, bring to light all unknown and hitherto undiscovered things and point out their true relationships to humanity.

Every Christian man is an expansionist. He could wish that he might clasp hands and hold loving relationships—if that were possible—with

every man living on this earth. He could wish that he might bear some relationship to every helpful and uplifting movement. Never is an inspiring word uttered or a noble deed done, but that each finds a response in his heart.

And this Christian man is going about all the while leveling walls and barriers that men set up, and so is opening up relationships where none before existed. To call any man who builds a wall about his affections or his means or his time or his endeavors, and thus acknowledges no relationships outside of those walls, to call such a man a Christian is a misnomer. The greatest expansionist that ever lived was Jesus Christ. He entered into active relationship with every soul that he met. He broke down more barriers and taught more about the brotherhood or kindredship of mankind than all other men besides.

Heaven for each soul is a place of greater expansion than earth, because heaven offers the greater number of relationships, and with less amount of disability surrounding each. And as each multiplied relationship brings new obligations, then that man who imagines heaven to be simply a place of individual rest and repose and enjoyment, has no right conception of the place that the expansionist Jesus Christ went hence to prepare.

God could not be God if he did not feel related

to every soul on earth and in heaven and outside of heaven. But relationships in order to be helpful must be mutual. In God are centered greatest power and glory and wisdom and goodness. If you and I could find each day some new thing about God and so place him daily in a new relationship to ourselves, why you and I could expand our lives indefinitely. Within what narrow confines must the soul of that man live who thinks of God in no other than the one relationship of Creator!

XI

THE HORIZON

THE thing of greatest interest at sea and out of sight of land is not, as I see it, the waters, so beautifully blue or green or gray; not the rolling tide-waves; and not even the wave expansion in all of its immensity that lies stretched out around us; but it is rather that circular rim of the ocean, as level as carpenter's spirit level, and equi-distant from us, that we call the horizon. In all the earth no such perfect circle, and one so clear cut and well-defined, has ever been drawn.

Strain our eyes as most we can, as we stand on

ship-board and survey the sea on every side, the horizon line is the extreme limit of our observation. Between that and us is the sea and the knowable; beyond is the great unknown, and the wisest sailor-lookout, as he paces the forward deck, looking sharply ahead with his well-trained eyes, sees with them no farther than you or I, and knows not a whit more than ourselves as to what lies beyond the horizon line. And the sailor is safe only because that horizon is in truth far away, and because between it and himself is a plain, open, and knowable sea, along whose highways he may map out safe lines for his ship. That he can widen that horizon line the sailor well knows, for he often at times of moment, either of great expectancy or of danger, climbs aloft and from the masthead looks out upon a wider and greater circle than could be seen from the deck's level. But not always does the horizon line stand out clear and distinct, giving scope to the ship to forge ahead at swiftest speed. For no sooner does a fog creep up out of the sea than does the sailor's horizon line become restricted and shuts in upon him. Soon perhaps the distance between it and him becomes so small that he could not safely drive his ship ahead, and so he slows down and sounds the fog whistle; or when, perhaps, in dangerous latitudes, he stops his ship and throws out his anchor.

The land, even on its most level plains or deserts, furnishes no such perfect horizon lines as does the sea. From even the most favored lofty spot the land line shows a jagged and rough outline against the sky. The line too is irregular in its distance, for it now recedes and now draws nearer to us. If we descend into a circular valley, the top of the hills about us, no matter how near they be, gives us the extreme limit of our horizon. Indeed, in a country of hills and trees we can scarcely say that we have a horizon line at all. And in a deep and unknown forest a man must either wander at random or remain still like the sailor in a fog.

There appear oftentimes upon our horizon some strange unfinished outlines that make us almost wild to see beyond the line and into the unknown. Upon the shore of the ocean the other day I saw off sea a bit of white topmast sail. How I would have liked then to see beyond the horizon and have discovered how many masts had my ship, where from and whither bound, how many tons, and what her cargo, how long she had been out upon her voyage, and whether strictly a sailing ship or a steamer. On the night of that day I saw a brilliant meteor fall out of the sky and sink out of the reach of my eyes below the horizon, and a little later, out of that same unknown, the great full, red moon came over the line and climbed heaven-

ward. Who knows what beauties and blessings and grandeur this same unknown has in store and in keeping for you and me and all the world!

Travel as fast as we may, and see and discover as much as we can, there is always a horizon line far ahead, and with all of its unseen and unknown things hidden from our sight. It were worth a man's life to travel to successive horizon lines, each step forward giving a new one, and so find out the unknown things that there await him.

No two men on earth can have just the same horizon lines of life. Some live in the mists and fogs, some on mountain-tops, some in the circular valleys, and some at the topmast lookout.

Some of us recognize the glories that lie in the unknown that are ours for the taking, and so travel fast and furiously to find them, while others drop sails and throw out anchor. The limit of the sight of some men is so narrow that they tread day after day in the self-same steps, and you can always know to-day what their thoughts will be to-morrow. And God is watching out of heaven the narrow tread of some men's lives down on "'Change," or in the commercial office, or some who sit daily watching their lock-box in the bank fill up, or some others, for that matter, who do nothing else in life but follow the furrows in the field.

No man can map out safe lines for himself, and so, steering clear of other traveling barks and of wrecks, forge ahead as heaven intended that he should, without having beyond him a far-distant horizon line. And no man can live as heaven intended him to live who, at each day's dawn, does not cross yesterday's horizon line, and so pass into new fields of knowledge and wisdom.

There is for every human being a horizon line which bounds his earthly life. That there is to this horizon a beyond, is just as sure and certain as that every horizon line on ocean's surface has also its beyond. God has not left his world wholly in darkness with reference to that unknown beyond, from which no traveler has returned to tell its story. And so we trust him for the mansions and for the home which he says are prepared for us, even though they lie beyond our line of vision.

XII

LANDMARKS

IN the immediate space above and about us, there are no waymarks. Every portion of this space is like every other portion. Search as far as you might, and you would find here not one single distinguishing character-

istic, and no specific object to mark locality. All space is unknowable and unnamable.

The same is true of the great waste of the ocean. You might cross the Atlantic ten thousand times, and yet you could not remember, by waymarks, one single spot and so go again and search and find it out. In all of space environing this earth, and in all of the oceans wide, there is not a Mount St. Elias, not one Gay Head promontory, not one Cape Cod or Cape Henry, and not one Washington or Bunker Hill monument.

This is not true of earth, whose every acre, save the trackless desert, has its distinguishing object or feature of the landscape, which serves as a guide. Earth is, therefore, full of localities, places, and names. Eschewing the lines of latitude and longitude, we could map out the whole earth by means of landmarks, such as boundary stones, tall trees, walls or rock, uprising hills and mountains, and builded towns and cities. As the pyramids in Egypt, and the Matterhorn and Jungfrau in Switzland, are landmarks and guides for scores of miles or more in every direction about them, so it is that we could find upon the world's physical map, in every square rod, some object great and distinguishing enough to point out to the traveler a continuous and plain way.

The landmark of a given locality is thus its glory,

its hallelujah, aye, its very salvation! Without a landmark the place is unrecognizable and therefore lost. All of the world's old landmarks removed, no traveler could go a mile.

What a beautiful array of names do we find in earth! In all of it, to every known and notable spot and place and object which serves as a distinguishing feature or landmark, has been given a name. These landmarks, with their well-known names, stand about us wherever we go, like the familiar names and faces of our immediate friends. It may be but a boulder, or a towering tree, or even a distinguishing bush, yet we greet them as friends as we pass them by.

Oftentimes at sea, when nearing port, I have seen the ship's captain scanning for hours the water's horizon dead ahead to discover perchance the uplifted form of some known object on the unseen land. For landmarks, when seen from sea, often take on ten or even one-hundred-fold in beauty and in value. And perhaps some day, under his system, Marconi's tall signaling poles will give through other senses than sight, landmarks to all the seas and from shores to shores!

And beyond this world's circumambient space and far up in limitless ether, God has set great shining stars and worlds—waymarks of the skies! The North Star, everywhere the sailor's friend

and the friend of all who travel by night, is doubly blessed among this host of the starry zones, because it gives you not only direction but also latitude. Perhaps in that dark abysmal ether-sea, to all angels and other spirits in their travels, these flaming stars serve as do lighthouses to the sailors of the earth. And one wonders what may be the angel-names for Southern Cross, Orion, and Pleiades, and other constellations!

As God is the glory of heaven, so man is the hallelujah of earth. The human world, like all other worlds, has its distinguishing and monumental objects. Every Saul of Tarsus, towering above his fellows in science, in mechanics, in theology, in works of humanitarianism, or in other field of human thought and activity, serves the world as a waymark, and stands for all, in some degree, that the Great Pyramid represents in Egypt, the Matterhorn in Switzerland, or the North Star in the heavens. Men in this world stand out as do objects in the earth's physical maps—some small and some great. You can travel backward five thousand years or more, in history, by noting the laurel-crowned names of each century.

Even if there were no hereafter, it were worth the living well, and it were worth the filling of our lives with higher thoughts and nobler deeds,

simply thus to serve as guides to human beings about us and following after.

On the seas of materialism, agnosticism, and unbelief, there is not an object in sight to mark place or to give name. The wind-tossed waves, though they rise mountain high and portentous, soon sink back to the level of the sea and are known no more. So it is with every hope that rises betwixt the man of material or doubting mind and his horizon. In all the literature of human disbelief you could not point a finger to a place or locality, or to a place with a name.

With the man of faith and hope and godly love, how different! For him there is a place, as well as a condition—and a place too, with a beautiful name. The life of the Christ who was earth's greatest waymark and shining star, is an earnest of this heavenly place and of life therein.

XIII

DRIFT IN NATURE

IT is not an uncommon thing, from a steamer's deck, to see a log bobbing up and down upon the waves. Of more interest still, in one of those strange currents so common in ocean, is it to see a long procession of

logs, seaweed, and varied land *débris*—derelicts all of them, whether great or small—upon the ocean's highway. No human eye may follow the log's course, as our ship leaves it far behind. Perhaps it soon will be locked fast in an ice floe off Iceland, or be rounding the Cape of Good Hope, or be caught in a simoon in the Indian Ocean! Who knows? Some day a great storm will drive it ashore and a great wave will toss it high upon the beach. Too wet even to burn, the landsman will leave it for the sun to rot, or for the shifting winds to bury!

On this same shore we have often watched the tides go out. Each incoming wave, falling short of the distance covered by its predecessor, has left behind a wave line of tiny flotsam—the parallel lines of all of which looking so like flounces at the edge of a garment. And search where we may, we can scarcely find a more heterogeneous assortment than an analysis of this shore line of tiny seadrift would discover to us. Among this seadrift we could find much detritus, substances worn from solid bodies by attrition, and reduced to small particles. Now, we are in the habit of thinking that drift is without potentiality. And, alone, so it seems to be; but in the hands of another it can become one of the most destructive of agents. All of the rocky sea cliffs of the world,

and the rocky wave-cut terraces, were carved out of rock, not by sea water *per se*,—for the erosive action of clear water-waves upon rock is practically nothing,—but by detritus in the grasp of the sea wave. The waves are ever ceaselessly at work with whatever drift they may find at hand. This drift not only carves out cliffs and terraces, but it builds bars and spits, and fills channels; all of which bring destruction and ruin to the mariner and his ship.

On this same seacoast, it may be, if the prevailing winds are landward, and the land is arid, we shall find sand dunes. These dunes themselves are as unstable as the drifting sands that compose them.

Poor drifting seaside sands, tossed hither and thither by wind and wave, what a weary life of ceaseless travel is ever behind and before you! Your sides have been worn by attrition too smooth for soil ever to attach itself to, or else there might be hope that some day you would find yourself anchored, and so at last find rest. Down at the seaside these drifting sands are no respecters of persons. The most highly cultivated field, or aristocratic lawn, any morning after a high wind and tide, may wake to find itself covered deep with a sand so poor and common as to be useless even for melting into glass.

Almost as easily perturbed, and as restless and as shifting as the ocean, are all of the world's great interior deserts; and here again we have wind and the same drifting sand. Woe to the traveler who expects to find in a desert, to be his guide, either path or footprint! Woe too, to the traveler who, in a desert wind-storm, has no kneeling, protecting camel behind which he may fall! No tree; no grass; no shade; naught but the ever-rolling, shifting, surging sands! They cover the great Sphinx. They threaten to destroy the world's highway—the Suez Canal. They bury out of sight and remembrance ancient cities, where tens of thousands dwelt in magnificence of wealth and power.

But in that desert somewhere, the traveler knows, are palm trees, and shade, and green grass, and a living spring of water; and under his feet he will find, he knows, a firm, steadfast and fruitful soil. And how in the drifting sand desert his eyes strain and his heart aches for this oasis.

The most infinite in numbers, the least homogeneous, the most restless of all drift, is the dust in the air. Take even a quiet, closed room; darken it, and then let in and across it a narrow band of sunlight: and behold the myriads of shifting, gleaming dust particles! You will thus get some idea of the trials and tribulations of the average

pair of lungs. Wherever there is drift, there is danger. Even the pure white snow, when blown into deep drifts, may suddenly engulf the unsuspecting traveler.

The world needs stable, fast-anchored souls in whom there is no wavering nor shadow of turning. God can trust such: and only on such rocks can he build. Such souls are the comfort and hope of the world.

The really vicious in this world are numerically small. It is the idle in the hands of the vicious who are the despair of religion and patriotism. One shrewd, ambitious, scheming politician, with a rabble to do his work, has often overthrown governments. It was the same drift rabble who, shouting hosannas, followed Jesus on Palm Sunday into Jerusalem, and a few days thereafter, at the instigation of priests, cried "Crucify him" and followed him in derision to his cross.

I know of no better way by which we may designate this human drift than the term "detritus." In the one kingdom, detritus may be harmless enough, till caught in the clutches of the wave it is made to carve cliffs and terraces out of the solid rock. And in the higher kingdom, we find that human detritus, used as a tool and in the hands of another, can be made the same destruc-

tive and powerful agent. In this human detritus lies the danger of the world. In a day it may rend a church. In a day it may pull down a throne. In a day it may defy the highest law of the land and bring a nation into disrepute.

The hope of the Christian is in the changelessness of God. If there were in him the shadow of turning, the whole human race would be a derelict upon the sea of eternity.

XIV

PATHS

PATHS are the insignia and the index of civilization. The broader, the smoother, the more level, and the larger their number, the greater the civilization. Look on your map for its railroad lines and its post routes if you wish the easiest way to arrive at the standing of a given section. Savages at best only have trails, while wild beasts prowl and roam by day and night over pathless and trackless wilds.

A path by day is like a lighted lamp in the night. And so far as the traveler is concerned, even the fairest and most pleasant lands need paths as much as do dark forests, wild woods, marshy jungles, and vast stretches of uncultivated plain.

And under what difficulties are some paths made. Yet there is not a mountain on earth on which by cutting out a zigzag track upon its face, or by hewing a continuous spiral line, you could not make a pathway even to the top. It is worth while to go to Switzerland, to drive up one of these zigzag mountain roads. One moment you are going east and with yawning precipices at your right; the next moment you have turned and are going west and with a precipice on your left. And it is worth while going to Switzerland to ride over the wonderful Simplon Pass road or to go down into Italy to see some of the old Roman roads. And what more lasting monument than a well-built road! These ancient Romans of two thousand years ago—themselves are gone, their cities are gone, but these roads, ever-enduring, still remain.

Paths are made with a definite object. They all lead somewhere. No sane man builds a path to nowhere. And you can easily judge of the relative size and importance of that somewhere by the quality and condition of its paths. Take me even to a solitary farmhouse, and by skirting around it I can tell you what road leads to the market-place and town, and what road leads to the various outlying cultivated fields, and which one leads to the spring somewhere, perchance in the clump of trees in the hollow.

As with streams that in Florida or in the West flow onward for a while and then suddenly disappear into earth, so there is ever a mystery about a path that turns and whose end cannot be seen. I have followed curve by curve a crooked railroad half a day to find what might be beyond the next turn. There is a fascination about a road that climbs a hill and then suddenly drops and hides itself from sight, and I have scaled a hundred hills to find where on the other side these roads lead. No forester who builds roads through wooded parks, no gardener who lays out walks through his flowers, evergreens, and shrubbery, but who marks out many turns and curves which, while serving ever to hide that which is before, thus brings each moment new surprises to him who follows the path.

The first rule taught the child learning to drive is to keep in the middle of the road, for there is danger on the road's outermost limits, and beyond these limits are rocks and stumps and gullies and brambles and bushes. But even a path broad, smooth, and clear ahead must to some have always in it much perplexity. You cannot make the way, try as much as you may, too plain and too certain and with too many sign posts, in which the world is to tread. For all the world is going continually somewhere, and for it daily there are countless

destination points. We would almost give our very lives, would we not, to have given us the power to make all these paths clear, even, and easy!

God's men and God's women are those who are daily making paths—smooth and easy paths—for all people. This is the world's *summum bonum.* For no more than commerce, can the world go without paths. It may be only a song in the dark, a simple light in a window, a kindly nod, the grasp of a hand, the loan or the gift of a dollar or a hundred or a thousand. It is not every one who has the ability and skill of a Napoleon, who built Simplon Pass, yet every one may open a path.

It is the surveyor with his chain and compass and theodolite; it is the man with the steam ploughs and shovels, the man with the broken rock or chert and cement or asphalt or vitrified brick—these are the true types of Christianity.

Like the ships that sail the seas, or like the stars that follow paths through the skies, so in comprehensive thought each individual life and all human life that is journeying onward is traveling on a highway and is going somewhere. There is a way that is called the "King's Highway" that is better than all other ways. The king himself opened up this way and with proclamation has

said, "This is the way, walk ye in it." To obey his commands and his rules (and search the world over you will find none comparable with his) is to follow on in his highway. But how the world is surging from right to left ; how men are trampling over boundaries and into briars and brambles, and how near they come to fearful precipices.

The King's Highway has on it many stations, but it is not every one who finds them. Most of us make this highway, alas, quite a long way, and too many of us make it an uphill way. For no matter how superior your track and equipment, are there not always some not quite happy travelers ?

And the end of the way is not in sight and there is mystery beyond. And for that very mystery's sake, and for the newness that we know that we shall find beyond, you and I all the harder will press on.

I have sometimes thought of the significance of the term, the heavenly city. It is a city, not only because of the multitude there, but because of the infinite number of its streets. The monotony of the plains or of the waveless sea is no part or portion of the city. And so in this heavenly city there must be a myriad of ways or paths, each one leading to a destination point that has its own delight and joy.

XV

OASES THE "ISLANDS OF THE BLESSED"

ORDS are never made till needed. You and I, untraveled, and living in this semi-tropical splendor of vegetation, would never have coined the word oasis. Yet to the frequenter of the desert no word in all the world is sweeter. For no other vegetation is so green, no other springs of water are so pure and sweet as those found here.

The most fearful conditions existing on earth other than being absolutely overwhelmed by fire or water one finds in the world's great tropical deserts. Here are found no highways, for every track of camel or man is soon smoothed over by the restless moving sands. And the bleached white bones of camel or of man, that represent the lives that have been sacrificed to the desert, may simply mark a lost way and a way contrary to the line of our intended travel. All day long a cloudless sun beats down upon the traveler's head, the hot sands under his feet hold heat enough to cook articles of food, and fierce winds of torrid air are strong enough to cover a whole caravan with biting particles that may as well be hot ashes from a live furnace.

Turn his eyes whatever way he may, they will be met on every side by only the most wretched landscape, a landscape in which there is no water, no rock, no tree, nor shrub, nor green grass. Here in this wilderness of death there is no sweet voice of nature, for when the sands are asleep there is stillness so awful that, as in deepest caverns, one hears his own heart throb and beat. One would as soon think of visiting charnel houses, or of walking, like Abednego, through fiery furnaces, as to go across a desert for pleasure.

The great desert of Sahara is the grand type of all the world's deserts. As it stretches almost from ocean to ocean and across the great continent of Africa (on the maps even designated by pock marks), it is but an almost boundless area of vast sandy plain—dreary, solitary, and arid.

Yet in this desert there are no less than six great oases, where human habitation in communities is found. And there are no less than six thousand smaller oases, where are found living fountains and date trees and palm trees and the verdure of shrub and grass. These oases are usually deep depressions in valleys, where water comes to the surface, thus making fertile tracts where there was but aridness, and thus converting sand heaps into mounds of living green.

No wonder the well-nigh water-famished and

heat-stricken caravan takes on desperate and almost incredible speed when in the desert there looms up in plain sight an oasis fair and beautiful. No wonder their hearts beat fast too as they behold even the mocking phantom of a shadowy mirage.

Think of refreshment, shelter, and rest—date trees, palm trees, and living wells of water—out in the midst of a desert. But what an environment to be born in and to live in must be a desert. How, as the long, monotonous days come and go, oft and anon those great volumes of parched sands must surge and beat like hungry waves against our living oasis. Sometimes, alas, the smaller and weaker ones in reality are engulfed and swallowed up, though perhaps with shifting sands removed, to reappear again some day.

The deserts of the world will be reclaimed. Every low-lying oasis tapping a water-line is an earnest by nature of what man scientifically is expected to do some day on a gigantic scale. There is abundant water for all of earth if we know how to go for it. Not an oasis, no matter how small, in all this world, but is doing its own blessedest best when in finding this water it sends forth flower and fruit and leaf and blade. Not an oasis, no matter how small, in all this world, but in all truth seems to some weary, famished desert traveler to be one of the many islands of the blessed.

There is water enough for all the world. The little oasis knows where and how to find it, and having found it, becomes a place of refreshment and life itself for all desert life. Now we know just such men and women. And life to us is worth the living—yes, a thousand livings—if out of the hard conditions in which so many of our fellow-mortals live they look to us as the worn and weary caravan looks upon the oasis of the desert.

God never painted a more beautiful picture on earth's surface than the oasis. Nor is his handiwork more gloriously revealed in this human kingdom than in the men and women who inspire in us hope and who give succor and help and refreshment.

How the desert sands surge against some people. How hard it is for them to keep the wells of water pure and uncontaminated and how hard to prevent themselves from being overwhelmed. For when an oasis is obliterated and lost, what shall become then of the traveler in the desert?

God never intended desert conditions to exist always. And this is your and my work. There is water enough for all the world. In our country's Western deserts artesian wells are being sunk and whole forests of trees are being set out.

The man who constitutes himself into an oasis

—date trees, palm trees, springs of water, shrubbery, green grass, and all—is by that much narrowing the area of Sahara, and is changing characters on the map from that of a pock mark to that of a spreading, growing plant or tree.

God does not ask more nor does he ask less than that you do your blessed best. That done, so long as you and the desert survive will pilgrims on earth and angels in heaven name you as being one of the islands of the blessed.

XVI

LABORATORY METHODS

THE analytical chemist stands apart from the great majority of the world's workers whose tools are crude, heavy, cumbersome, and inefficient, and whose materials, unfortunately, are usually of the kind called "commercial," and whose product is intended for the general and not over-critical public. The requirements of the chemist are far more severe in tool and material; for his work must be exact, complete, full, and true. A half-truth from him could never be tolerated. His work, moreover, is far more general and comprehensive than that of others; and to this end he must have the most

perfect instruments for crushing, pulverizing, weighing, digestion, precipitation, filtration, washing, drying, etc. He must have scores too, of reagents or tests, every one of which must be chemically pure. Not a drop of water, for example, can he use except it be distilled.

The world demands of the chemist absolute truth—nothing less. She sets him to work out an infinite number of problems, all of which he must do with mathematical precision and finish and with a nicety unknown in the realm of other workers. To fail in any of these in the slightest, means the rejection of him and his work. A chemical analysis, in other words, means that our worker must first find every individual ingredient or element in our unknown compound, and then determine the quantity by weight of each. If he falls short in the finding of one element, or wrongly determines a weight, his analysis is worthless, and as such it might do a world of harm. There is, indeed, only one word that could be fittingly inscribed over the doorway of all chemical laboratories and that word is "Truth."

Chemical analysis is, the world over, a process of discovery. The chemist begins in darkness and then turns on the light to see what haply he may find. If he knew beforehand, or if he intended to coerce the truth, if he is biased, or if his

mind is already made up, what is the use of his scales and mortars and flasks and beakers and crucibles and blow pipes and acids and alkalis?

And because each chemical problem for analysis is undertaken in the dark and with solution every whit unknown, then each analysis must have neither heredity nor environment; it must stand alone and disassociated from all else on earth. No chemist ever approached his work with other thought than this. The chemist is like one, in truth, who goes into a door and closing it shuts every jot and tittle of the world outside.

In chemistry the worker takes things as he finds them and not as he wants them to be. He might prefer that the rock he is assaying shall be gold bearing, or that the water for analysis shall be lithia, but what is that to truth? In the realms of chemistry it is experience, which is the finding out by trial, and not hope, which discovers truth.

The process of analysis is confining, slow, and exacting. The not uncommon fee of five hundred or one thousand dollars on the part of the chemist, affords us some idea of the tedium and skill required in order that absolute truth may be obtained. Largely the process consists at first of repeated tests. In this process there are no short-cuts, however desirable this might be to the worker in his wearisome toil through the days and weeks.

The world is full of the compound, the complex, and the unknown. The chemist with all of his patience and skill, fails ofttimes to break up the complex into its simple constituents. And not infrequently in the final report of his analysis we find the fateful word "undetermined."

I once heard a man say that from a religious standpoint he would exchange places with no other living man; for, said he, I do not know what any other man believes, but I do know that I humbly yet sincerely have faith in God. This sure confidence was the result not of hope, but of experience—the finding out by trial—and of test. The religious problems that confront every man are the most momentous things of his life. These problems are full of the complex, compound, and the unknown, and the saintliest of us all must die and leave behind at the last, many, so far as earth is concerned, undetermined. But all the way the Christian life here and beyond is a process of discovery, and his work always is to discover truth.

But what one of us, pray, in this search in the moral realm, is brave enough and wise enough and with sufficient thought of personal responsibility, to engage in this work, free from bias, prejudice, environment, and heredity? And how few of us, alas, dare use the laboratory methods of scales and

crucibles and mortars and pestles and retorts and acids and alkali tests! Who of us in the perplexing and complicated moral questions that daily confront us, goes within, and there alone without question, shuts the door and so leaves every jot and tittle of the world outside and searches simply for truth?

XVII

THE MEDIA THROUGH WHICH WE SEE

SEVERAL years ago it was thought there had been discovered a new gas, one thousand times less dense than hydrogen gas; it was called "etherion" by its discoverer, because he believed, and so argued, that it is this gas that fills all inter-star space.

At the top of Mont Blanc in mid-day, with so much of the baser and more obscuring portion of the atmosphere below and under your feet, an observer looking up into a dark blue velvet field, sees clearly the faces of shining stars. Imagine yourself standing on the moon, with no atmosphere about it: nothing but this hypothetical "etherion." How ineffably pure the outlook would be! How absolutely clear and pure and straight would be every ray of light that came to you from every

one of the millions and millions of scintillating stars! About you and over you would lie no pall of dust and ashes and soot, such as envelops the earth. About you there would be no over-hanging earth steam, or vapor, or fog; no lofty cirri or ice clouds; and no low-lying dark rain clouds. There in that lofty, clear, and pure empyrean, how every luminary in the heavens would glow and shine as no mortal on earth has ever seen them!

Follow a sun ray as it sifts down through our atmosphere. Here it goes through one stratum of mist, and there another; here it gets certain color as it passes through one dust stratum, and there another color; here it is reflected from one smooth-surfaced particle, and there it is deflected by another. A falling leaf that flutters to the ground is not less varying in its earthward course as it falls than is a sun ray. And the sun ray falling to earth is tinged at varying times with the colors and hues of all the media through which it passes, and on account of these changing, shifting media, the sun and the sky never look twice just the same.

The moon that rose the other evening at eight, as we looked at it along the earth's plane, was big and swollen and red. The busy day had filled the atmosphere with earth-red dust and other particles. The hot moist earth was constantly sending up-

ward tremulous heat waves. We saw the moon through a thick and clouded atmosphere. As it rose higher and higher in the still and quiet night the dust and all air impurities settled down upon the earth's surface, and it, showing a seeming smaller globe, shone ever more and more with silvery whiteness. And in the morning when the air was still more pure than at midnight, our silvery moon changed into cold steel. But all the while it was the same moon at which we were looking. The moon never changed one whit. And how often does the sun set in the evening with the same big red face that we saw in the moon, and for the same reason? And yet it is the same sun, though with redder face than we saw at midday.

Bring a fish accustomed to a water medium out upon shore. The sunlight streaming through air media blinds and stuns him. Perhaps if you and I should scale to heights above five hundred miles and could look through an etherion medium into the unobscured and blazing lights of heaven, we too would be blinded and we would fall down and cover our faces from the light, as did Israel, when they beheld the shining face of Moses after he had come from the mount.

How bedraggled and soggy and orphaned does the world look through an atmosphere of rain!

How pure the world looks through an atmosphere of snow! How fresh the world looks through the atmosphere of a spring morning! How a winter evening, with the sun gone down and when the sky is gray and lowering, and when the limbs creak on the trees, and the earth, frozen hard, rings like steel under our feet, how, in looking through an atmosphere of this kind, do we, cold and shivering, hasten homeward to the warm fireside that awaits us; and how seated there in light and warmth and amid sweet companionship, our very heart and mind seem to thaw out along with our fingers, ears, and toes, and how, forgetting the icy world outside, the world within us, looking through another medium, takes on a summer's warmth and hue!

I have stood in God's acre, while the sun shone brightly and while the birds sang merrily, when the clods were fast hiding away my heart's love, and the very sun seemed forbidding and cold and all the birds made but jarring discords.

Each of us largely makes his own atmosphere: and the world sees us through, and judges us by that atmosphere. Do not blame the world therefore, if it believes you cold, selfish, uncompanionable, and unfeeling. And through this atmosphere, builded by us around ourselves, we see

other people, and other people seen through our medium seem just like ourselves. We are constantly crediting to other people (and innocent people) those vices that are the most rampant in our own hearts. We absolutely see God himself through our own atmosphere and we transform him into a being as unlovable as ourselves.

And what queer ideas some of us have about heaven as seen through the medium of our own atmosphere? To some it is simply a place of divans and cushions, of golden pave and pearly gates, and of angelic music. To some it is a place simply of eternal rest. To some it is simply a place where everything will be handed around on golden trenchers and where there will be nothing for us to gain and attain through our own struggle and endeavor. To some it is simply a place without sin and sorrow, and where the soul will have no more enemies. To some it is a place of absolute equality and where every man is made as good as every other man and where there is no man better than any other. To some, heaven, in seafaring phrase, seems the universal harbor where all the individual crafts shall some day ride forever safely anchored. How strange will it be to such to find heaven to be the open infinite sea and the scene of infinite endeavor!

We do not get these visions out of the Bible.

Every one of them is individual. They are our own atmospheres. If you and I could cast off our own atmosphere and surround our minds and hearts and souls with spiritual "etherion," how different would men and God and heaven seem!

XVIII

FROST

THERE is, I believe, no agency in all nature more fearfully destructive and more widely feared than frost.

All through the early autumn and the late spring months this universal monster is dreaded by green and growing plant life. On some still night, when the world is asleep and in the dark, and oftentimes with smallest warning, he steals upon some given area and with a million silent mowing machines lays low all tender vegetation, whether it be bud, flower, leaf, or indeed the whole plant. The morning sun never looked upon a deadlier battlefield with condition more direful than does this same sun every morning in the early fall and in the middle or later spring in some parts of the earth. In the higher altitudes or latitudes these dreaded nights come sooner, but in all latitudes they come at some time,

save in the frostless lands that lie for the most part down in the tropics. Clouds, fogs, rains, snows, dew, and frost all depend upon the condensation of the aqueous vapor in this envelope of air that is piled up some forty miles deep around this earth of ours. Yonder moon would be infinitely cold, but it could never have a cloud or rain or snow or ice or a frost, if it were without an atmosphere.

It shows the spirit in this monster when I say that it is in the clear, calm, cloudless nights that frost is most operative and distinctive. A given area, indeed, is fairly safe from frost when clouds and fogs—these are earth's warm blankets—prevail.

The wind too is frost's enemy, for the wind keeps the air strata disturbed and prevents them at night from arranging themselves according to gravity, viz, the heaviest, which is always the coldest, at the bottom. The warmer air which during the day collects near the earth at night rises to higher altitudes, while the cooler upper air having greater density and weight settles upon the earth.

By reason of this fact that the higher air altitudes at night are filled with the day's warm air strata that come from below, the orchardist and trucker long ago learned to plant all early and tender crops on hilltops and hill or mountain

sides, while the hardier and all late crops were planted in the low lands. The sun through all the day is storing up heat in the earth and into plants. But the sun gone down, these objects radiate their heat fast into the air and soon become colder than the outlying air. The better radiator an object is the quicker will the frost settle upon it. Damp ground is a better radiator than dry ground, and low damp lands in the valleys is frost's favorite habitat.

It frequently happens by means of radiation that low-lying plants will be killed by frost when air ten feet above will show a thermometer above thirty-two degrees Fahrenheit, or above freezing. A signal office's report of the lowest temperature of the night before would give that temperature at the level or height in the air about his instrument. But the plants on the ground below would show a temperature of several degrees below this —a fall sufficient perhaps to freeze the plants stiff in the frost.

Snow may act as a blanket and prevent the earth from radiating her heat. Vegetation may be kept green under the snow. But frost freezes the sap in the ducts of a plant and they burst like the water pipes in your house in January.

One does not have to go to Florida, where he may see a whole State's chief industry paralyzed

perhaps beyond recovery, in order to discover the spirit and work of frost. For there is not a soul in the land that owns a plant, and that loves it, but at the proper season is on the lookout for and is guarding against this, the plant's greatest enemy.

If one's plants are few he can cover them with inverted pots, or paper or boards, and so prevent the earth and the plants from radiating their heat. In a hot-house a lighted lamp may keep the temperature above freezing. In large areas stationary or portable smudge fires, giving out a great amount of smoke that settles down as a cloud or a blanket upon the landscape are largely used, and especially in orchards. The partial flooding with water of a certain area will keep temperatures up and thereby prevent the falling of frost.

That there are in non-tropical regions certain warm or thermal belts, and that some of these are frostless belts, is well known to science. In the mountains of North Carolina there are several such regions. The theory is that the cold air settles to the bottom, while the warm air rises from two to seven hundred feet and spreads out upon the hillsides and furnishes heat to them before it cools and so descends. This circulation of air during the night is the salvation of the belt.

Thirty-two degrees Fahrenheit at earth's level

means frost in all the kingdoms. A smiling face above may not signify necessarily that upon the heart, fifteen inches below, there does not rest a stratum so cold that it sinks that organ to the frost point. Periodical heart frosts do far more harm than was ever done by the worst of Florida frosts. It is easy enough to keep the frost out on sunshiny days with the sun and warm air to help us. It is when the sun goes down,—this is the time of danger.

It is possible to keep ourselves on high levels and so to surround ourselves with conditions that make for warmth. It is possible for us to keep this heart of ours in a vernal, thermal, or frostless belt; and God demands no less than this of us. God demands that we shall keep the flowers that he gives us, so that every blossom shall, despite frosts, mature safely into fruit for his gathering.

XIX

FOGS

ONE morning in Zurich, Switzerland, a party of us telephoned to the top of the Rigi to know what manner of day to-morrow would be.

The answer came back: "It is foggy to-day, but

will be clear to-morrow." Now a sunrise view from this mountain is worth going half-way around the world to see; but no matter how far above earth and lofty that eminence, what matters it if there be a fog? All the suns of the universe might rise, but they could not gild one of the hundred snowcaps glistening white about us, nor would they discover evidence of Germany's wonderful Black Forest, nor show any trace of valley or lake or plain far beneath. One, indeed, might sit on the throne of the universe with enchantment spread out above and beneath and around him—but suppose there were a fog?

Now a fog is no respecter of persons or places. It may hug the ground and settle down pall-like and cold and clammy, over the meanest swamp or the loneliest moor, or it may fill the Strand in London! Its presence means bewilderment and making uncertain the way of the most timid wild animals, as well as that of the lordliest man. I have seen a fog cut a mountain just in half, or possibly nip off its extreme and pinnacle end, and so hide it from sight; and I have seen one that had climbed far out of the dust and grime and soot of earth, and had ascended ten miles into eternal purity—yet a fog still!

But it makes great difference to us whether the fog is above us and in mid-heaven, or all about

and around us. Nature has been kind ; if she had made the fogs to be earth's constant carpet in place of hanging them as curtains and draperies in her lofty chambers, then we should stop traveling, for no light yet discovered will appreciably penetrate fog.

Fog is heavier than air, and if it were not for the matter of temperature, and for the fact that air currents from earth are constantly rising,—factors that keep the fogs mostly above earth and in mid-air,—why earth, a large part of the time, would be wrapped in a fleecy, vaporous blanket. You have doubtless often watched these aërial fogs, now slowly, softly floating, now tearing across the heavens like an express train, now black like ink (perhaps boiling furiously), and now showing all the gray and lighter shades, even to whitest fleeciness ; now evaporating and dissolving, and now standing still and sullen and glowering like some chained mighty monster.

Before there can be a fog or rain, warm, moist air must first be chilled. Chilliness and consequent fog come from expansion of air through its ascension into higher and colder strata of air ; or it follows whenever and wherever a warm, moist current of air meets a cold current. The warm wet air of the sea meets, for example, the cold air of the land, and thus the coast line is everywhere the

line of great condensation and of much fog and rain. The varied warm and cold currents of water in the ocean is the primal cause of sea fogs. These sea fogs often lie so low on the waters that a ship's topmast stands out above them; their confines are so narrow that a ship often runs through one as quickly as a train runs through a shower. Sometimes they will lift for a moment or two and then impenetrably blindfold you again.

Fog has no power in itself. It is a white-sheeted ghost that now ascends, now descends, and now moves and stalks, or motionless stands, or now dissolves into thin air. Fog itself cannot hurt us. But it can shut in and narrow our horizon, it can make uncertain our course, and it can hide lurking dangers. I recall an evening in mid-ocean. All day, with the dreary whistle keeping tab of the time, we had been ploughing our way through fog, never being able to see a ship's length ahead, when suddenly and without warning we met and ran by a three-masted ship, that in passing almost scraped our sides!

Doubt is a fog, and like a fog it may float high and ethereal and intangible in our mental and moral atmosphere, or lying low it may blur and stop our onward course, or it may shut us out at last from harbor. Doubts are mostly sheeted and

ghostly, with shape, yet void—things that now come and go, now dissolving and now reappearing.

The doubting man is the man with the chilled atmosphere about him. If he had, perchance, a warm impulse proceeding from within him, it would be met on the outside and converted at once into fog. To the man with the chilled atmosphere everything appears as a mist and fog and doubt. He doubts the God who made him, the Christ who saves him, the heaven prepared for him, and the brother by his side. Whether standing on the Rigi or in the valley, this man is surrounded by fog. Put him on ocean's highway, or on the Strand, and he becomes at once a positive danger to navigation.

The average man, if the clouds are quite high in the sky, scarcely is aware half the time that the sun is not shining. Then what a pity you and I cannot send our doubts high up where they cannot hurt! If we must doubt, then let us send this fog ten miles up in the sky, and out of harm's way, and make draperies and snow banks and odd faces and shapes out of it, to our heart's content. No ship ever anchors, and no ship ever dashes headlong into another, at sea, simply because it happens to be sailing under a lofty Cirrus!

God is the world's sunlight; but even the sunlight, striving as it may, cannot pierce fog!

XX

THE PROPERTIES OF MATTER

IN the highest sense, this is a utilitarian world. All things are for use, and each thing is for an individual use. That use is dependent upon the individual inherent qualities or properties that may be possessed by any given subject-matter. And no one thing can fill out its destiny and serve its purpose of being until the world has found out, through these inherent properties, for what good it is.

These properties are the physical romances of the nature world. The marvel of gold is its malleable and ductile properties. One ounce of gold can be beaten so as to cover one hundred and sixty square feet, and one grain of it can be drawn into a wire five hundred and sixty feet in length. The wonder of silver is that it is the whitest of all the metals, and that it has no equal as a conductor of heat. Bismuth is the most diamagnetic element known—a sphere of it actually being repelled by a magnet. Iridium is practically untarnishable and is well-nigh infusible. Aluminum, white in color and non-corrosive, is also the lightest of all useful metals. Antimony has properties that make it a necessity in all anti-friction metal alloys.

The metal magnesium differs from all others in that it, in the form of a thin ribbon, burns with dazzling brilliancy, and is useful for signal lights and flash lights. Platinum is a necessity in the making of vessels that are needed to withstand fire and acids; it is therefore indispensable in the chemical laboratory. Mercury has strange properties that cause it to melt at temperatures above thirty-nine degrees Fahrenheit, and it has properties too that forbid its ever being touched by any other metal than platinum and iron.

These are a few salient properties of a few of the metals. These are qualities in truth that differentiate all the different metals. These are all invested and inherent qualities. In the case of each metal above, these are the characteristics that are present, and are the essential attributes of the metal in question. Your counterfeits might be as yellow as gold, or as bright as silver, but if they do not possess all of the properties of these two metals they would by no means be gold or silver. Of all various matter in nature, each type possesses therefore individual properties that can never be absent from it. Each type has its own life purpose, its own sphere of usefulness, and its own inter-relationships with all other matter.

We must not suppose from this that matter is unalterable and unchangeable. If we heat soft iron

filings to a red hot heat, they lose all of their magnetic qualities. If we heat mercury to nearly six hundred and eighty degrees, it becomes at once the useful red oxide of mercury. By well-known processes we can convert iron into steel.

These latter states, however, are in reality new states, and with their own properties. Of each type there may be of course subdivisions. There are, for example, many kinds of iron—each useful in its own way, and for some peculiar specific use according as are its properties.

The price of an article is somewhat dependent upon the fact as to how abundantly it is found in nature; but worthiness and true inherent value depend solely upon properties. Gold, no matter how abundant it might become, would always be of great value, because it is the most malleable of all metals. Platinum will always possess great value, because it stands at the head of the list among all metals in point of ductility and fusibility; and iron too will always be of great value, regardless of the quantity of it that is mined, because no other known metal possesses so great tenacity.

Each human being in the world is a unit and differentiated from every other because of certain invested inherent qualities or attributes within

him—qualities inherited or gained by individual effort. Every human being is worthy or unworthy, he is of value to the world or he is of no value, according as these qualities are possessed by him. These worthy attributes may be either mental, or moral, or both.

If the various properties of matter in the physical world—adaptations to certain ends—seem marvels for us to wonder at, then how much more beautiful and adaptive must seem those properties as possessed by the human being into whose keeping have been given economies of the world! The true-heartedness of gold, the lustre of silver, the untarnishableness of iridium, the anti-friction qualities of antimony, the dazzling brilliancy of magnesium, the qualities as found in platinum that cause it to withstand fire and acids—we find in truth all of these properties among human beings. And there is many a human life so transcendent in some property or quality that it seems a story from a romance!

In all the kingdoms, the nobler the qualities, the higher and more useful the life and the larger the sphere of work. One wonders, and with a great yearning, to know just what wondrous properties are inherent in angels and archangels!

It is only in commercial life that the rarity of an object helps to fix its market price; for although

there may be myriads of angels and redeemed in heaven, yet the fact of this great number, I am sure, does not lessen the beauty and loveliness of the least one of them. Gold in the higher kingdom is of value not because it is rare, but because it is gold!

XXI

STRESS AND STRAIN

WHEREVER a blow or pressure is exerted from without or against an object, there is a corresponding power or force within the object that resists the attack. The amount of this resisting power is the measure of the object's strength, and if objects did not have this resisting power, then there would soon be an end to all organic matter. It is unfortunate that the science of mechanics has no distinct name for these two opposing forces. It seems strange, indeed, and yet as a matter of fact it is true, that of the two names stress and strain, each one by different writers has been used to designate three separate and distinct things. In other words, the external force and the internal resisting force and also the harmful result of the two forces have each in turn been called by some stress, and by others strain.

The only difference between the infinite number of varied tortures that can be inflicted upon the human being, and the stress and strain that can be inflicted upon all matter, is that while the former is sensible of pain, the latter is not. A stick of wood, a bar of iron, a block of stone can give as strong evidence of a strain as can a person.

Matter is vulnerable from every side. Tensile force can elongate it, compressive force can shorten it; transverse force can bend it, tortional force can twist it; while shearing force can cause one part to slide over an adjacent part. And in these five ways, and from tens of thousands of varied forces, all matter is undergoing constant and ever-recurring stress and strain. And theoretically and truthfully every stress, no matter where directed, and in the human being or natural world—every strain, no matter how small, leaves its mark. The microscope could assuredly discover and show it. Now if this resultant were too marked, then all matter would be short-lived. But in nature's economy we can bend many things and yet not break them.

There can be no stress or strain of matter that does not to a certain extent weaken cohesion and does not cause displacement of molecules or particles. If each of these molecules could always fly back in perfect elasticity to its aforetime place,

then matter, so far as outward forces are concerned, would be immortal. But all matter that is subjected to stress or strain has a more or less limited life. And so variable and so cumulative is the wear and tear, which is the effect of stress and strain, that no civil engineer or architect ever dares to trust matter to its theoretical life-limit and to its supposed extreme power or strength.

Matter possesses this strange quality; it can withstand far more external pressure when that pressure is exerted slowly and little by little and continuously, than when it is directed all at once. But the strangest quality of matter is its cumulative effect. Matter that can withstand sixty thousand pound pressure would after a time be destroyed under one-third or twenty thousand pounds pressure, if that pressure is exerted at different and stated times that are sufficiently close together and that are continued long enough. A continual succession of blows will break anything. Trip hammers, iron axles, piston rods, steel rails of railroads—all have a limited life and a life that is cut short, not from any one prodigious blow, but through a long succession or series of repeated shocks, through minor blows. Wrought iron under continuous vibration, which is indeed a series of small blows, will assume crystalline structure, and will show largely deteriorated cohesive powers.

As powerful a force and as all sufficient for a time as is elasticity, yet even elasticity grows weak and fails under constantly repeated stress and strain, no matter how minor the blows may be.

There is a vital point in mechanics known as the elastic limit, or yield-point. Up to this point matter, if it is relieved of strain, would recover its former status; but beyond this point there could not be a total recovery, and there would result either what is known as a permanent "set," or a breakage and a total falling away.

In this human world we do not take heed as we should to these laws of stress and strain. If we did there would be fewer broken hearts and fewer broken bodies and constitutions. While God has given to the human being also this blessed gift of elasticity, yet it is a fact that, under repeated and oft-returned stress and strain, the human being too at last loses the power of returning to a former place and status.

Woe to the man who adds to the stress and strain of the world! The tiniest burden that you lay and lay daily upon yonder heart will bring it, far sooner than you think, to that "yield point" from which there is no earthly recovery. And if it is a larger burden that you bring, then (though

there may be a corresponding resisting force in every being) if under continued stress and strain trip hammers fly to pieces, and if seventy pound steel rails break, and if wrought iron bars under continuous vibration assume crystalline structure and become greatly weakened—then what chance has your human victim, who is far weaker than any of these?

As against this I am sure that all that heaven knows of tensile, compressive, transverse, tortional, and shearing stress and strain is from information afforded by earth. For the burden of earth's stress and strain comes up to heaven—to Christ and God, and guardian angel, and perhaps to redeemed! How heinous must be an offense whose burden rests upon two worlds! And in that clearer atmosphere of heaven, how magnified must look even the microscopical stresses and strains of earth!

XXII

FRICTION

HE voice of friction is a cry of pain. It is a warning note of danger and always tells of or presages disaster. If you will dissect most of the noises heard in earth, sky, or water, you will generally find the above qualities in

them. The creak of axle wheels, the whirr and noises of machinery, the clash and clatter and roar of the street, the boom of the breakers and the hoarse noise of the surf, the deafening din of the waterfall, the shriek of the cyclone, the moan of the wind, the roar of the thunder, the peculiar noise that a bullet or shell makes in mid-air, these are only the beginnings of the myriad voices of friction.

Though all of these cries come from inanimate nature, yet they are the self-same cries that pain is ever calling forth from the animate world. Nature claims that the rudest bit of gearing and the roughest cart wheels can suffer as well as the lordliest prince. If pain never cried out the world would never succor and help. And the voice of pain, whether from the animate or inanimate world, can never be mistaken.

Friction is a force that acts between two bodies at their surface of contact, which resists their sliding the one upon the other. The amount of this force depends upon the force with which the bodies are pressed. It is quite easy to see that friction is greatest with soft and least with hard materials.

Possibly it is not so well known that friction in the matter of wood, metal, and stones varies, so long as no abrasion occurs, only with the pressure,

and by no means at all varies according to the area or surface over which the pressure extends or upon the velocity of the moving body. For example, friction is the same, no matter how slowly or fast your train or cart may go. Friction is the same, no matter whether the steel rail of the railroad be two inches wide or four or whether the tire of your cart wheel be narrow or wide. And contrary to general belief, the friction or "pull" of belts over pulleys does not depend upon the width of the belt. A two-inch belt, doubled in thickness and thus made strong, would produce as much friction as a four-inch belt.

Friction is the evil genius, the "*bête noir*" of mechanics. It is friction that "slows down" all motion and finally stops it. What an easy thing mechanics would be if we had only to start a thing in motion and after that it would go on unaided forever.

The constant aim of mechanics is so to construct and conserve that as little force or pull as possible is required, or, in other words, to get as near to perpetual motion as can be. The nearer to this point that mechanics arrives, the less wear and tear and abrasion and destruction there will be to all engines and machinery.

I know of no more brilliant example of the effects of friction, and that too between the hard-

est of substances in the thinnest of mediums, than is afforded us by meteors. The composition of these, by the way, is often almost identical with that combination of metals out of which Uncle Sam makes the armor plate of his warships, nickel steel. And yet a meteor, should it strike our atmosphere in a line parallel with the earth and thus have a great distance of travel, would soon, through friction, heat into a blaze and burn into ashes. Large meteors, striking the earth's atmosphere at right angles and thus not having more than fifty or sixty miles of distance to travel, often strike the earth before complete combustion.

All of the woods, stones, and metals have differing coefficients of friction, and this dissimilarity has large meaning in the world of mechanics. There is a great number of patented metallic compounds that are used for bearings on account of their small frictional powers and low conductivity of heat. Various parts of engines and machines, where there is constant pressure and wearing motion, have frequently sections of other metals inlaid at these points. Your watch is full of inlaid jewels on which the tireless pivots of scores of wheels rest. Without these anti-friction jewels, your watch would never keep time, and your bicycle too would be fully as useless without its hard steel ball-bearings.

L. of C.

This planet of ours, high in space, swings safely in its orbit without friction. Nothing retards it. It never wears. In a sense it seems perpetual motion. This is on account of the medium or rather the lack of medium through which it passes. But upon the earth's surface there is, alas, noise and clash and clatter, and wearing and heating, and one constant cry of inanimate matter that is going, through friction, to its destruction.

Rub up against people if you want to find out what kind of people they are. If you wish a thorough test, press hard. If you escape without friction and heat, set that man down as an equivalent of a bit of blessed anti-friction metal and covered with the best of lubricants. Blessed are the "Babbitt" and "Magnolia" metal men and jewel inlaid men of the world. If all the world were like them there would be no friction, and if no friction then no noise, no jars, no retarding, no stopping, no blocking of the highways. If all men were anti-friction men, then this world in space would not go more easily and swiftly along its way than would this human world that is set down on its surface. If there is a worse world than this earth, then it is a place of greater friction. "And what is heaven like?" Go into some modern engine room. The big driving

wheels weigh tons and tons. But in the midst of all that whirl of wheels and driving of piston rods if you were to shut your eyes you would not know that there was indeed a thing in the room. All the souls that go to make up heaven are like the parts of such a well-oiled, noiseless, anti-friction engine.

The poorest authority on friction in all the universe might be an angel in heaven.

XXIII

FORMS AND SHAPES

WORDS are always more beautiful when we use them in their primal meanings. It is a serious thing to place an old word in new relationships. It is because our words have drifted from their original moorings that the Bible seems the quaint and almost antique book which it is. The old word "form" needs the above preface. In its loftiest meaning it is synonymous with essence. Thus, while God made man after "his own image," yet it was the Christ only of whom it was ever spoken, "who being in the form of God."

Form is an actuality developed. It is a something imposed upon an organism by its essence or

life, and not by something else, and this imposition is done from within and not without. Form is a perfected thing and a definite thing and a finality. It is an essential and not a non-essential.

In the material world form is physical structure, definite and ultimate, whose life essence has been developed into an actuality along the lines of fixed order or arrangement. It is by this specific formation or disposition or arrangement of this manifold matter or parts that one life or essence is differentiated from another life.

Form is the key of the life within. It is by form that we know the one from the other, a man, a horse, or a lion. A tree has form. It is the spirit within that gives the tree its distinct, definite, perfected, and essential form. We could not give a tree form. It is this form of the tree, standing out clear and distinct, that differentiates the tree from all other things in this great world of creations. God gave it its life and its life's outgrowth form to be all its own and to keep.

Form is nowhere more beautifully illustrated than in crystals. The form, perfected, definite, and essential, of a given salt or stone is its crystal. There is something within which fixedly determines for the spirit of carbon or quartz that its ultimate development shall be that form which we know as the diamond or the quartz crystal.

Our word form is not limited to the material. Music has forms. We have, for instance, the sonata form and the rondo form. The two spirits of these two forms are wholly different. The essence of a sonata by no possible manner of means can develop into a rondo form.

When you close your eyes and think pictures, or when at night you dream dreams, if you see in these one single form, then this form is necessarily specialized and determined for it and is imposed upon it by a spirit or essence within. Our minds must think in spirits or essence, and these spirits must develop into forms which our eyes see. Dreams are the real things that they are because we see not merely shapes but forms.

A tree is no less a tree because storms or other agencies have caused it to lean to the north, south, east, or west, or have twisted it into knots or gnarls, or because these agencies have shorn it largely of its limbs and foliage. These conditions are mere shapes.

We know something of what the essence of a cloud is, and we know that this essence, developed, takes on a certain form which we call a cloud, yet our cloud takes on new shapes with each new puff of the breeze. These shapes are the non-essentials, the indefinites, the unsubstantials of cloud life.

Nature gives us our total idea of forms. The whole world is full of forms, individual and specific, and these forms are mostly beautiful. For nature is meant to be helpful, and helpful things are good things, and an essence that is good must develop into a form that is beautiful.

It is only the developed, the definite, the complete things that have forms. If you are indifferent and if your life is indefinite, nothing grows out of your life but shapes. And it is surely no small part of the world's men and women whose characters, all unformed, are liable to assume daily new shapes.

There is, as I have said, no entity, material or immaterial, that is complete which does not have its definite form. God, the risen Christ, the angel host, and cherubim and seraphim, all have forms. You and I, rid of the material, must have forms as definite and as knowable as those we have today. John, who saw aloft the redeemed in bright array, saw forms that were the essentials of the spirit within. And since in the material kingdom, as is well known, forms grow all the more wonderful and majestic as we ascend the scale of being, so we can only imagine what may be the majesty and glory of all of heaven's higher forms, forms that perhaps are beyond all earthly ken.

XXIV

LUBRICANTS, THE PEACEMAKERS

THERE is no such thing as a perfect anti-friction metal. There are no metals on earth that being rubbed together fast enough and hard enough, would not ignite and burn up; nor if rubbed together more slowly with pressure, would not wear wholly away. Such a rubbing too would draw forth from the metal a creaking and a crying as if it were indeed suffering pain.

The antidote for all friction, and friction-noise is oil, lubricant oil, whether of mineral, vegetable, or animal origin. There is not a piece of machinery that has wheels, cranks, pistons, or pivots, no matter how simple,—from the tiniest watch to the biggest Mogul, and from a wheelbarrow to a vestibule train,—but whose very life, so far as motion is concerned, does not absolutely depend upon lubricants. Friction is a state of war. Friction in the end means annihilation !

Now the office of lubricating oil is a beautiful and interesting one. Oil, to begin with, is made up of oil globules. If a thin constant film of oil is made to flow between two bearings, the bearings will rest on this oil film and as a matter of fact

will never touch each other and will not therefore heat and wear. Moreover, the bearings glide easily and smoothly because they rest on oil globules which move among themselves almost without friction and with a swiftness and smoothness almost inconceivable. The oil globules thus become peacemakers as between that which without them would be warring factions.

That surfaces ideally lubricated do not at any point touch, because of this oil film made up of oil-balls, is easily proven. An engineer, only a few days ago, was telling me of a certain famous engine in England whose plan or method of lubrication was so absolutely perfect, that when it was taken to pieces after six years of running, it was found that certain tiny marks on the metal, left by the workmen, which friction in a few days would have worn away, were still left intact, unrubbed and untouched!

There are certain qualities that it is patent all lubricants must possess. They must possess sufficient body to keep surfaces that are under pressure, free from contact. An oil as thin and light in density as is corn oil should not serve as a lubricant. Again, the oil must possess fluidity; it is just as possible to have too heavy and sticky an oil as too light an oil. That sticky, gummy, gritty, dusty substance that you see on so much

machinery is not a perfect lubricant; in truth, it is about as harmful as helpful. The oil too must have capacity for storing heat, and it must have a high flash or burning point. An oil that is not cooling to the parts, and that at the lower temperature decomposes and burns up, would be valueless as a lubricant. And lastly, the oil must have no corrosive action on the metals.

Now there are the greatest number of oils that fail in some of these points. The lubricating oils are the few and not the many.

Oils must always be adapted to the individual machinery or engine, and according as to whether there is much or little pressure, or fast or slow speed.

Lubricant oils, as a rule, weigh seven and a half pounds to the gallon. And a one thousand horse power engine will theoretically use per annum about two and a half barrels of cylinder oil. There has been great advance in the past decade in the methods of supplying oils to machines, so as to give a constant flow and a film that is evenly distributed all over the surface, and so also as to keep out all dust. If these three points could be attained in all machinery, and just the right oil in all cases be used, the life of machinery would scarcely, so far as friction is concerned, have an end.

A peacemaker is one who stands between contending parties, and who is himself under pressure from both parties, yet who through peculiar inherent qualities on his part receives no harm himself, and yet who at the same time prevents actual contact and consequent friction on the part of the contestants. The highest term of approbation in the Bible is "blessed," and it is this term that is applied to peacemakers.

Now if mechanics can find a lubricant for each individual kind of machinery, if all the wheels and axles and pistons and pivots of earth can be kept at peace with their environment and can be by this means made to move so smoothly and swiftly and easily and noiselessly, is it not strange, then, that human wisdom, to say nothing of Christianity, has not done more to make peace among nations and individuals? Are wars necessities? And how much of litigation is not only useless but absolutely immoral and criminal! How all the bickerings and brawls and cruel blows and curses must sound, up in the ears of heaven—sound, aye, even worse than would all the sounds from unoiled axles and wheels and saws and pistons combined, of earth.

If universal peace on earth is ever to come, it will not be till every man is converted into the similitude of a lubricant made up of oil balls easily

moving among themselves and possessing fluidity and heavy enough to bear burdens and so prevent harsh contact as between all contestants. The human lubricant too, in order to be a peacemaker, must possess the power of storing heat; the power of always presenting a cool surface; the power too, of possessing a high flash point. The human lubricant would fail utterly if he by any means possessed qualities that were corrosive in their nature to any surface.

Human lubricants—nations and individuals—are badly wanted in the world just now and have been for years past. I fear that the mere conqueror, the commerce-seeker, and the goldhunter are abroad in the world and that they are creating a deal of friction. Perhaps there are other ways of bringing about results that make for civilization than through cruel war, extermination, and bloodshed!

XXV

HEAT CONDUCTORS

HE first and great necessity for this world of ours is heat. This universe, perhaps, could not have a greater cataclysm befall it than to have all heat taken away from our solar system, thus reducing our magnificent planets to

the desolate and lifeless conditions found in the moon. Heat, therefore, occupying this highest position, gives a high relative position to all objects that seem closest allied and most friendly to it. In fact, so important is this point, that we have actually an arrangement of the solids, liquids, and gases of the earth, according to the intensity of their resistance to the general dissemination of heat. The degree of resistance or non-resistance of them all has been measured and set down. This whole question is covered by the term "conduction of heat." Our theorem, then, is that things possess quality according to their individual heat conductivity. Now here is a list of a few solids, showing their relative heat conductivity in degrees: silver, 100; copper, 73.6; gold, 53.2; tin, 14.5; iron, 11.9; steel, 11.6; lead, 8.5; platinum, 8.4. A good common rule for finding out the conduction of heat, and so quality, is simply to determine density. Next in density to the metals come stones; next come hard woods (dry woods are better conductors than wet, and woods lengthwise with the grain better than across grain); then come liquids; while gases are such diffused substances that they posses almost no appreciable conductivity. All spongy articles are poor conductors, because they are full of air. We thus see why a laundry flat-iron is made out of iron

rather than stone or wood ; and we see how, when the ironer wants an obstruction against the heat, she puts cloth about the flatiron handle.

Now, as far as the temperature is concerned of wool, sponge, rock, or iron, the thermometer might show the same degree of heat in them all. But if you place your finger upon iron, the metal carries away the heat of your hand so fast that the hand is left with the sense of cold, whereas the poor conductivity of wool actually gives the hand the sensation of warmth.

Certainly one of the marvels of nature is the action of water (and air acts in the same way) when heat is applied to it. If water and air were immobile like iron, then great distress would follow to humanity. It is most fortunate, indeed, that water is an imperfect conductor. If we had to wait for our water to boil through simple heat conduction, then we would not get our morning coffee till after breakfast, if at all. But nature heats our coffee in another way, and so evades the hardships that the loss of heat conductivity would entail upon us, by circulating the water—the bottom hot stratum rising at once to the top, and the succeeding stratum observing the same rule, and so on. This is called heating by convection. Hot air likewise rises from the earth, and cooler strata are continually taking its place.

Heat and electricity both being modes of motion, and being therefore closely allied, we expect naturally to find that heat conductivity and electrical conductivity are about equal in the same substance. Indeed, the sordid electrical man would give millions if he could subvert the conduction laws that obtain among all metals; it would mean fortunes to him if he could substitute iron for his costly copper wires. But copper, he must have, because he wants to push forward his waves as fast and as far as he can and with least resistance. He must have wires of high conductive power, or else his current, always seeking lines of least resistance, might be diverted and so lost to him for the purpose desired.

Now, to return to heat: if the metals were not the fine conductors that they are, you might have to weigh out your gold and silver in dust form and pass them as currency without the government stamp and without the emblematic goddess of liberty or the great American eagle. If the metals were not the good conductors they are, there could not be wrought out one single iron or steel structure, or machine, or railroad rail. Gold and silver would largely lose their value as moneys, and the other metals would lose their value for strength and for their ten thousand other purposes, if metals were as poor conductors of heat

as are air and water. And if this earth were not the fair conductor of heat that it is, then spring might take half the year for her coming, and in fact might never come at all.

The grand *pronunciamento* of the angels was "Glory to God in the highest, on earth peace and good will"; and every man on earth is expected to be a personal disseminator of this greatest of all rules of action. Oh, the faces of men, if men were love-conductors and not the obstructionists that they are, would glow and shine like the metals that are heated to white heat in the fire! What does the infinitely white raiment of heaven, and what do the shining faces of the angels and redeemed signify but this? God must rate men as the chemist rates his metals—according to whether they are good or poor conductors of the divinest of heaven's laws. It is of tremendous moment to you and me in the moral world to know that silver means 100, tin 14.05, lead 8.05, and gas practically 0!

I can imagine that at some remote time in the past, water made lament to nature, that under the universal law of conduction it could be of so little use in the world. Nature was kind; and she put that added power into water whereby it could convey heat as quickly as precious metals.

Perhaps this same plaint daily comes up to God from the humble human being. Could God be less kind than nature? Cannot the weakest, lowliest being on earth, get added power for the asking? Has not God sent his almighty Spirit into the world for this specific purpose? Can any man at last at the bar of heaven plead that it was impossible for him on earth to rank in conductive power even with silver and gold?

XXVI

THE CENTER OF GRAVITY

THE gravity of the earth is ever pulling every terrestrial object down to itself. These pulls are exerted in parallel lines, and the resultant of these parallel forces always passes through a point in the given object which is called the object's center of gravity. At this point, or center of gravity, the whole mass of the body may be considered as concentrated. And if the body is supported at this point it will, if acted upon by gravity alone, balance in every position. It is not difficult in uniform bodies that are circular or square to arrive at the position of this center of gravity. But every object, whether it is a regular and geometrical figure, or whether it

is an irregular, heterogeneous mass, has its center of gravity; and it is possible always to find out this point with mathematical precision. In all tall or vertical objects the base of the support and the vertical line passing through the center of gravity must be carefully looked after, for the instant that line, along which the earth's resultant force proceeds, falls outside the object's base, the whole object must needs topple over and fall to the ground. The brick mason who builds a wall understands the true value of a base and vertical line. In felling trees I have often seen a tree so straight, and with limbs and foliage radiated so uniformly on every hand, that although it was cut in half on two sides it yet remained standing, and the axe man would have to push it in order to make it fall, while the center of gravity of other trees was so far outside of their base that with a small amount of cutting they would come crashing down. Of course a leaning tree could never for a moment stand and so maintain its integrity if it were not that the roots like so many ropes kept it in the air.

Few things are more ridiculous than is the attempt at walking of a duck, whose legs are after all chiefly paddles, and which by no means fit into the body at the center of gravity point. The center of gravity of birds that fly and live in the air is different from that of the birds that make

their living on foot. Because he leans forward and has therefore lost his former center of gravity, the old man must needs walk with a stick. In fact the various gaits of men, and indeed of all animals, are dependent mostly upon where within the body they place the center of gravity—this position in the case of men being quite optional. The teacher of calisthenics in teaching one how to stand and how to carry himself and how to walk, is mostly teaching him just where to place his center of gravity. Things that lean, through whatever cause it be, and so make it possible that the resultant line of gravity-force may fall outside of their base, are a constant danger to themselves and to everything about them.

Of all forms on earth that are least liable to a wreck through a change of their center of gravity is a pyramid. The center of gravity in this figure is on a straight line drawn from the vertex to the middle of the base and one-fourth the distance up. How difficult it would be to make a pyramid topple over is thus readily seen. And *this certainly is the reason why mountains are given by nature pyramidal shapes*, and why mountains, probably because of those shapes, are regarded as the most steadfast and sure things of earth. The center of gravity of a train of cars on a straight line is different from that of the same train on a curve. There-

fore, to remedy this on all railroad curves the outside rails are higher than the inside. Astronomers have been greatly worried to find some central sun about which all starry systems revolve—some given point that is in reality the center of gravity, that might therefore be considered as the centralization of the total mass of the universe. But such a point has never definitely been found.

It may be within the range of possibility that the center of gravity of the universe may be heaven. It matters not whether heaven is or is not a material place. The center of gravity of a system may be as well as not out in empty space. If it is true, as it is, that the center of gravity of an object is that point at which we may consider all of the object as being concentrated, then this idea comports well with the thought that heaven could well be, whether it really be or not, the centralization point of the universe.

Of far greater importance perhaps than is the position of the center of gravity of our physical body, is the question of the center of gravity of our soul and spirit. It makes all the difference in the world as to just where the concentration of our being may be. It makes all the difference in the world as to whether within us the resultant line of force or pull falls outside or inside of its base.

People that have no base have no stability. To stand, with them, is an impossibility. And likewise, the narrow-base men must stand exceedingly circumspect or they fall.

A duck that is trying almost in vain to walk is not a more ludicrous sight than are hundreds and thousands of men whose concentration or center of gravity is in a different place from that which they would have it appear. Such people are constantly wobbling and falling.

We must not forget that the ideal geometrical figure for stability is the pyramid. The base is broad and the centre of gravity is not high from the base. There is a spot somewhere within us where God lives. Is that point, or some other point, our center of gravity? Is that spot, or some other spot, the concentration of our being?

XXVII

BY-PRODUCTS SOMETIMES CALLED "WASTE"

ASTE" is another name for ignorance. In the economy of nature there is no such thing or term as "waste." Nature intended, wherever and howsoever the multitudes are fed, that the basketfuls of the remainder should be taken up and used. Indeed, the more intelli-

gent the human race or single man becomes the less final loss there is, the greater the saving, the greater the number of commercial "rescue missions," the more valuable become the by-products, and the greater their adaptation and conversion into all manner of glorious uses.

I know of no more interesting plants than are our cotton-waste factories. I look upon them all as philanthropic and intensely moral institutions. Here are the leavings of the spinners and the looms, the floor sweepings of the mills, and the yard sweepings of cotton warehouses, the waste (?) of the woolen mills, the tired out cotton bagging and the worn-out carpets, behold these and much more are all gathered here—an inglorious company —and are made into new and bright forms, and are sent out daily to the four corners of the world to serve the needs of mankind.

Down on the plantation ask the farmer if he throws away the "waste" (?) from his cows and oxen and horses and pigs and sheep. He will point you to black heaps on the fields to be spread out and turned under; and later he will show you growing crops made all the more luxuriant by this fertilization that they received.

Look for a moment at the product of the cotton boll out of which come the garments of the world, and the white wings that sail over the seas in the

cause of commerce. There was a time when cotton seed was largely an absolute waste. To-day our cotton oil mills manufacture from these seeds many grades of cotton oil (for medicine and illumination and for food). They manufacture linters, which are the sawed-off, short cotton fibre as taken from the seeds, and the once rejected cotton-seed hulls are to-day a prime cattle food, and are made also into paper. A second by-product—a by-product of a by-product—is the soap stock from the oil refuse. And every new use of, or increased value of these by-products, increases the value of the original cotton boll in the field of the farmer.

By-products are the delight of the chemist. The German laboratories are daily startling the medical and commercial world with their new products among the "wastes" (?). See all of that helpful and wonderful group made from "waste" (?), and which the doctors call "the coal-tar products"! Look at the marvelously lustrous and permanent dye colors made by the Germans from this self-same vile-looking stuff. The pine trees that stand in the forest, the material coefficient for the building of the dwelling-places and homes of all the dwellers in houses—this pine tree when cut up and put into heated retorts, turns out scores of wondrous oils and acids. Out in the Alabama iron mills

they are finding new uses for the slag of the furnaces. And the generated noxious gases they are now using for heretofore unthought-of purposes. We shall not go further. There is to-day a great and shining host of "lifted up" things that if they had tongues would shout hallelujahs! The magicians of to-day—descendants of Fairy Aladdin—are calling up wonders out of the sea and air and soil and rocks, and out of dust and out of ash heaps. He who finds a new use for a by-product is adding to the world's store of wealth and well-being and comfort. He is the world's benefactor.

Think you that I am carrying my parallel too far when I think that I see analogous things in the religious life?

If I read my Bible aright, I believe that I find that faith is the primal thing. Faith is the thing I find that saves me. And this is reasonable and logical. The highest honor one can pay to man, angel, or God, is to have faith in him. Faith is the basis of all civilized life. Our banks without faith would close to-morrow. Nobody would deposit money, and I am sure nobody could borrow money, without faith.

But there are by-products of faith that shine like stars for beauty. They go along with faith, but Christians utilize them to a greater or more

limited extent—and some Christians scarcely at all. I conceive that a man can have saving faith, and yet possess the minutest amount of the Christian graces. But among Christians of the higher order he would not be much more useful than is a savage when compared with a civilized, cultured man.

The by-products of faith, as I take it, are charity, kindness, unselfishness, truth, hope, patience, beauty, and many more. And then come all the Christly commands—beautiful to obey. And a man who uses all of these by-products is indeed only "a little lower than the angels," and is himself blessed among men.

God has made salvation a very simple thing. He has not made it dependent upon signs and wonder workings. But there is not a manufacturing laboratory on earth that should be half so full of physical by-products as should the ideal Christian's life be full of the by-products of his faith.

XXVIII

OVERTONES, OR FULLNESS OF LIFE

IT is one thing to make a simple tone. It is quite another thing to make a note. A note is complex; it involves besides the fundamental tone also what are known as over-

tones. The overtone is what I shall call the fullness of life of music. It is everywhere the test of the musician and of the musical instrument. Pitch is dependent upon vibration. From twenty-seven and a half vibrations per second, the lowest note on the grand piano, vibrations reach as high on this instrument as four thousand two hundred and twenty-four, the highest note. Middle C is 258.65 and its octave above is double, or 517.3. If we strike middle C string, it vibrates along its whole length two hundred and fifty-eight vibrations per second, and we have C tone and pitch; but if music stopped here, there would scarcely be a musical instrument on earth or a harp in heaven. Happily music does not end, it rather begins here. For our fundamental tone, produced by the vibration of the whole string, is greatly reinforced by other tones (their number varying with the quality of the sonorous body), the complex result making music the beautiful and helpful thing that it is.

These reinforcing tones, harmonies, or overtones, are ever on the ascending or upward scale; thank heaven for that! Harmonies could never be undertones; for to produce them we must have a longer string than that of our fundamental tone.

The cause of the overtone lies just here: Whenever a string vibrates throughout its whole length, it also vibrates in one-halves, one-thirds, one-fourths,

etc. Middle C piano string vibrates as a whole two hundred and fifty-eight per second; its two halves vibrate each with double the vibrations of the single string, or five hundred and seventeen per second, which tone is one octave above. The string also divides into three parts and four parts —each one-third or one-fourth part vibrating with three or four times as many vibrations as the whole string, giving us thus still higher tones than the octave. There may be besides these five, six, seven, eight, or twelve, or possibly infinite central segments in vibration.

The proof of the overtone is to be found in the violin. Frequently the player after making a fundamental note, will shut this note off entirely by putting his finger on the middle, or one-third, or elsewhere of the string. The result will be overtones alone sounding high, clear, and sweet.

Above all instruments and strings the human voice is capable of greatest richness of overtones. The vocal chords of a superlative prima donna in her best notes would vibrate so as to make the most complex overtones; indeed, her whole physical being, in sympathy, would vibrate. If she stood upon glass, this too would vibrate; and fine sand placed thereon would resolve into certain individual shapes that we might call the musical signature of the singer!

Besides the matter of hearing, science shows us that we, as regards our other senses, are dependent upon vibrations. Without vibrations the great suns of the universe could shed no light out into the infinite darkness. But it is only in the more recent past that we have come to know that life and thought and emotion are also dependent upon vibration. There could be no life without vibrations. Cessation of vibrations means death. Any force that interrupts this perfect rhythmic vibration means discord, which is illness. Vibrations are our only source of impressions. Our soul, which is our subliminal self, stands in relationship to our bodies and our environments as does the organist who sits before the organ, which is itself dumb, but being struck, swells and thrills with tones and overtones. The perfect soul is thus a vibrant, creative center. The world is full of its vibrations. Not one is ever lost!

The law of vibration is perfect. The discouragement is the faulty instrument that gives us so few overtones; and on the other hand the non-impressionable dullards who cannot hear. For true it is that if the tympana of our ears, minds, and hearts do not thrill with and in unison with the varied incoming waves, then we might as well have ears of stone. Marconi can set the waves of ether

three thousand miles all in vibratory thrill; but if there is only stock or stone over on the other shore, or perchance an electrical instrument that is not attuned with Marconi's, then Europe can never get our messages.

For the sending out of light there is betwixt sun and earth intermediate vibrant ether. So between heaven and earth and God and man there is in all truth a medium just as perfect as that made for light, or sound, or other sense. You never had a thought of God, proceeding from this vibrant creative center of yours, but faster than light, God knew it! And if we were not the dullards that we are, God could never have a thought of us but that we would be far more receptive to it than is the photographer's sensitized plate to light-waves.

The ether of the moral universe is all athrill with thought. What joy means this to sublimated redeemed, and angels, and what converse and communion—time and distance and dull sense all annihilated! This sluggish earth will be lifted ever up into the greater fullness of life, and sickness and pain and death will to the larger degree be driven away, the more impressionable the more correctly attuned it becomes.

Above all of nature's sounds and those of man-made instruments, God made the human voice—of wondrous and abounding tones—to be the

sweetest and richest. And God likewise in our whole individual life of deed and thought and emotions, has surely some royal thought for us that does not compass simply and alone fundamental notes, but also a myriad of overtones! What overtone fullness of life have we? How far removed are we from the dullard, or how close to the sentient seraph!

XXIX

THINGS HOMOGENEOUS

A SUBSTANCE is homogeneous when all of its parts are of only one kind, when there is congruity of constitution, when there is agreement in elements and likeness and correspondence in characteristics.

Pour iron filings and sulphur together or water and oil and your product masses will be heterogeneous and not homogeneous. Our substances will not strictly mix, and by simple mechanical means you can separate again and isolate their component parts. Take alcohol and mix it with any one of a large number of the fluids and you get products that have agreement and likeness in all of their parts, products that are congruous and homogeneous.

The earth's soil is heterogeneous. Examine with a microscope any selected portion of it and this fact is easily seen. The various rocks are largely heterogeneous. Externally they show streaks of many colors or of varying hardness. Granite is composed of three component parts that are all visible. Pound a bit of granite—Scotch, Quincy, or Georgia—in a pestle, and with a microscope you can mechanically isolate its parts. In all boulders and conglomerates and stones these incongruous parts can be easily seen. It is a simple matter to detect mica, iron, pyrite, or quartz, in almost any compound rock that you pick up. Most of the precious metals as found in the rocks are easily and separately discoverable and at the same time can be isolated by mechanical means.

On the other hand, the water (hydrogen oxide) that we drink is a compound mass that is homogeneous. All parts of water have the same characteristics, and you cannot separate water by mechanical means, but only by chemical means. Lime (calcium oxide), quartz (silicon oxide), salt (sodium chloride), sulphuric acid (sulphur, oxygen, and hydrogen), nitric acid (nitrogen, oxygen, and hydrogen), are all homogeneous. Fine marbles are homogeneous substances. That beautiful company known as crystals and crystalline formations

are homogeneous substances. Copperas (sulphate of iron) and bluestone (sulphate of copper) are well-known homogeneous substances. There is not one of the above homogeneous substances whose component parts can at any time be isolated mechanically. Not only this, but in each case the union of all its component parts has given a product, as we have seen, that is a new fabrication and a new creature and with new properties.

Heat is a large factor in the production of homogeneous compounds. Mix to your heart's content in a cold retort copper filings and zinc filings and you can accomplish no union of the two. You can in turn sort out and so separate again both the copper and zinc. But put fire under your retort and melt your zinc and copper and you will find that your cooled product is another and a homogeneous substance known as brass. To examine this brass will almost lead you to believe, so beautifully homogeneous is it, that brass is one of the simples and not one of the company of the compounds. Copper, zinc, and nickel filings will never mechanically unite. But a heated retort full of them shows, when cooled, a product just as perfectly homogeneous as is brass, a product known as German silver. There are among the metals about one dozen that unite in various ways to produce

about thirty compounds known as alloys. These alloys are all homogeneous. They, while they are plainly compounds of the original metals, are just as evidently new metal and with new uses and new properties. These new and homogeneous compounds, formed out of the heterogeneous, all belong to the domain of chemistry.

A conglomerate, made up of several rocks, is not of much use to lapidary or builder. You could not polish such a stone for the life of you. They are stones too, for the builder, of inferior and unequal strength. Their principal use in New England, where they abound, is in the building of fences, for what does a real estate owner care if the fences of his fields do show that the rocks thereof are but a patchwork in stones?

Now we have seen just such people. They have good parts and they have distinctively and separately parts that are quite bad. In colloquial language they might be said to be made up of a streak of lean here and a streak of fat there and something else yonder. You can see in them, as in conglomerates, separate bits of mica and iron and quartz and pyrite scattered here and there. You feel sure that you could sort them out into their varied component parts. Such people are plainly not homogeneous. They are, on the con-

trary, heterogeneous, and they fall short by this much.

God, I must believe, never intended that the human and divine in us should be mingled and mixed as in the conglomerate. This seems clear from the use in the Bible of the term "new creature," as applied to the human being who in faith has received the Spirit of God. No conglomerate in the nature world is ever known as a new fabrication. This term is applied only to those compounds that are homogeneous, such as German silver, brass, copperas, bluestone, marble, etc.

The "new creature" of the Bible is a being whom you could not mechanically dissect. He is not made up of varying strata or glacial products. It would be impossible to find in him just where the divine left off and the human began, or *vice versa*. He is not man, he is not God; he is in all truth and verity a "new creature."

XXX

VISCOSITY

A FLUID is a substance that, being acted upon at a given point, continuously yields with continuously decreasing deformation. The antithesis of this is the solid, which is

a body that, being brought into a condition of stress and deformation, retains that new shape so long as this condition of stress is continued. A rigid solid can be defined as a substance that, being acted upon, knows no yielding. An ideal rigid solid, therefore, would be a substance which, no matter if all the stress of this world were applied to it, would experience no deformation, no strain. This is an ideal. No substance is absolutely rigid. There are for all substances on all sides deforming forces and a consequent yielding strain and deformation. The bodies that we call rigid solids are in practice all found to yield. Iron and any of the other metals, when acted upon in small masses, demonstrate that they are not rigid.

While, in strict truth, rigidity therefore is not a thing of comparison, and no rigid substance is to be spoken of as being "more" or "less" rigid, yet in daily practice rigidity is a thing of degree. The various solids differ widely in the matter of rigidity and differ in their yielding power, and exhibit, under stress, various degrees of deformation.

When we begin to classify substances along this line we meet with strange facts. Jelly, though soft and easily deformed, is not a fluid because it does not flow; it is therefore, a true solid. Beeswax, sealing-wax, pitch, and paraffine, though not easily deformed, are true fluids. If a cake of cob-

bler's wax is placed in water, with bullets on top of it and corks under it, the bullets and corks will traverse it in opposite directions. These substances will fall or rise, according to their relative weights, and the wax will flow around them. While these substances are true fluids, yet their flow is extremely slow, their resistance to flow being extremely great.

The term for resistance to flow is viscosity. The glacier that so slowly flows down mountain gorges, wax, molasses, syrup, weak syrup, cold water, alcohol, hot water, ether—are examples of liquids whose flow is successively the more rapid, and whose viscosity, therefore, or resistance to flow, is successively the less. As there is in nature no such substance as an absolutely rigid solid, so likewise we may state that there is no substance that possesses perfect absence of viscosity or perfect mobility.

If we conceive of a fluid that is of infinite viscosity or immobility whose resistance to flow is infinitely great, we can easily see that there would be practically no difference between this fluid and a perfectly rigid solid. Water under great pressure in the seven-mile depths of ocean possesses far greater viscosity than at ocean's surface. The center of the earth is a subject of intense interest. We must believe that this center, on account of

heat, is a fluid. It has been computed that the pressure at this center is something like forty-five million pounds per square inch. This pressure, then, must be so great that its mass, under force and stress, behaves exactly as if it were indeed a rigid solid. From this earth's center—an approximately rigid solid—we should have to conceive of the fluid mass outwardly growing softer and more soft till we arrive at a thin mobile fluid of no great viscosity upon which this twenty-five miles of earth's crust floats.

Earth's center, therefore, affords us theoretically our best example of perfect rigidity. Probably no force or stress, as known, could cause in it deformation or strain. All the battering rams of the ancients and all the cannons of to-day could not harm it. It is the one immobile, immovable, steadfast thing, without deformation, in this material kingdom of our earth.

In the moral world the thing that is immovable and steadfast, the thing that under stress even the most severe shows no strain and deflection and deformation, is of all things the one thing the most necessary. If I lay a tenpenny nail upon an iron anvil there results here a certain deformation. This deformation is so minute that it becomes an immaterial matter and not a vital one to

mechanics, but if the forces of all of this world were exerted against truth and truth yielded, then heaven itself would be unstable, insecure, and assailable. For truth is not truth and heaven is not heaven if in them there is the shadow of turning.

It is of greatest comfort to know here in this world of little viscosity, as applied either to material objects or human kind, that there is a place of perfect rigidity and of infinite viscosity, a place immovable and eternally the same.

The farther one goes away from truth and heaven and God, the more mobile and the less resistance to flow, the more yielding he becomes. Hell would be a place where, from a moral standpoint, there is an entire absence of viscosity, a place of infinite mobility.

How the Deity in pity must look upon the human being whom he sees yielding at some point almost every moment of his life! And how much such a human being needs God, whose promises to him are immovably sure and are certain of fulfillment.

Infinite viscosity and perfect rigidity of substance in all the kingdoms would mean that which all the forces of earth or hell could not assail to the point of its slightest deformation. Against all onslaughts, all temptations, it would remain forever safe, secure, invincible, and unyielding.

XXXI

RADIATION OF HEAT

WITHOUT heat there can be no genesis of life. This applies as well to a world as it does to the smallest seed-capsule or blade of grass. The moon is dead because there is no heat in the moon. This earth, as well perhaps as the other planets, is clothed with verdure and filled with animal life because of heat. Now heat, good mother that she is, cannot be self-sustained. Heat, perforce, must manifest itself, and must reach out and aid everything about it that is less fortunate than itself.

We expect luminous bodies like the sun to send out heat (as well as light), but it is not always so easy to see that even the non-luminous bodies are continually exercising this function. But take any body containing heat, place a thermometer on every side about it, and the thermometer at each place will rise in temperature, no matter whether the thermometer be in a vacuum or in air; the higher the temperature in the source, the higher will be the rise of the mercury in the thermometer. Place a hot and cold body near each other, and the heated one will continue to lose its heat to the cold one, till both bodies are in equilibrium. And in

truth even after there is a state of equilibrium, this continual radiation of heat goes on between the two; but as each receives as much heat as it remits, the temperature in both remains constant. Now it would seem almost unfair and unrighteous that the colder body should have been allowed to thus rob its fellow. But such is the law of heat.

There are bodies that radiate their heat more rapidly than others. And there are bodies that absorb heat much more rapidly than others. These are matters of daily test, and in the scientific and practical world these two facts are of incalculable importance.

The effect upon yourself in coming into the presence of a cold object is to be chilled. If you stay in its presence long enough, and it is big enough and cold enough, you will eventually lose so much heat that your body will be in a frozen state. This heat will have gone out of your body and into the cold object. This is the principle upon which the refrigerator, the ice-cream freezer, and the still bigger artificial ice-machines work. Any one who, at sea on a temperate day, has ever run into the presence of an iceberg, well knows how quickly he gave up—and into the iceberg—seemingly every degree of warmth in his body.

The degree of radiation is inversely as the square of the distance; and this is why in winter we draw

especially close to the fire, and why in summer the immediate presence of a big ice-box is so refreshing. In the one case we wish to steal and so absorb as much radiated heat as we can, and in the latter we wish to give away and ourselves radiate as much as we can. In all cases it is the warm things of earth that must give up, and it is the cold things that are the receivers of this radiated wealth.

To prevent, at times, too rapid and great radiation on the part of the individual, nature has provided such things as non-conductors. The bark of a tree is a partial non-conductor of heat, and prevents in great stress of winter the warm sap of the tree from radiating its heat out into the cold air, and so, freezing. The feathers upon birds, the fur upon animals, protect oftentimes the individual in winter from a radiation that might mean its actual death. The dead and strewn leaves and mould in the forest, are non-conductors and prevent the warmth in the earth from radiation; and so it often happens that in January, and even on snowy days, by scratching down under the leafy coverlid you can find tender green things living and growing that would die if exposed twenty-four hours out in the open. But the most anomalous of non-conductors are snow and ice. The farmer in the far North and West knows that he will cer-

tainly have a good wheat crop if he can only get a permanent winter coverlid for it of snow.

We are scarcely conscious of the great heat that is in our earth, and how much heat it must constantly radiate, until down in some excavation like the Mt. Cenis tunnel we see how the workman's limit of heat endurance is measured by minutes, and not hours. It is this radiation of earth that makes its enveloping stratum of air warm and habitable by the human race. As one ascends and gets farther from the influence of the earth's radiation the air is felt to be colder, and up at no great height science tells us that when clouds form they turn into the tiniest and most beautiful of icicles.

It is a crime to be a cold-hearted, indifferent man. One such man often chills a whole community. Extend our thought farther toward him; conceive of him, as you have a right to do, as being immensely large and well-nigh infinitely cold; then in that state he would freeze and paralyze a whole city. Indeed, in the presence of such a one, the average human being feels the need of a non-conductor like the bark of a tree or the feathers of a bird or the leaf mould on the ground.

The mission of Jesus Christ, as is shown by his social life on earth, is to bring about equilibrium between men. His greatest and his chief mes-

sage as between man and man is, "Love one another." This is why we find the missionary in the slums of our great cities and in the far-away portions of the earth. And let me say that if man were not such a poor conductor of heat the warmth of Christ's heart and the fervor of his life would long ago have so warmed mankind's heart that there would be to-day perfect equilibrium between earth and heaven.

Then, indeed, if it is only the warm-hearted, only the loving, the heat-radiating ones, that do God's work in the world—the amount of their work individually done being according as is the love in their hearts—then, alas! how often must God look down upon this earth, far away from him, and see somewhat the same thing that the physicist often sees through his telescope high up in the air, and far away from earth;—icicles, and icicles alone!

XXXII

FOR THE PROTECTION OF LIFE

EARS ago a young companion and myself were out hunting. We were within fifty feet of an open wood cleared of underbrush. By the merest chance, when looking just

within the wood, we saw, near some straggling grass, a quail. If we had not been quite small boys we would have given the bird a chance for his life, and so would have flushed him. But we were too young for such high thoughts. In a second there was a report, and we ran to pick up our bird; when lo! to our amazement, we found not one dead quail but seven!

Looking back at that event to-day, the only notable thing of it all was that a few insignificant hillocks of dead grass—though we were almost upon them—should have hid and protected, from all discovery, six fine birds. They were totally invisible, even though, through the incautious exhibition of himself by one of the covey, our eyes were trained upon the spot.

Throughout my hunting and field-and-wood rambling days I kept running across exhibitions of this kind. I found that (good mother that she is) nature's constant endeavor is to shield and to protect and multiply life. No means for her are too humble and mean for use. A tussock of grass, a clod, a cluster of leaves, a knot-hole in a tree, in her hands are converted into safest fortresses, behind which a pet child (all unconscious perhaps of immediate danger) is ensconced. Not one time in a thousand, even though the setter dog be right upon them, and though he point directly toward

them, does the hunter ever see one till he is in air. The animal seems to be aware of his safety, and hoping that you may go another way waits till your feet are ready to crush him. And so I have routed thousands of rabbits, and flushed tens of thousands of birds, and have marveled, as they sped away, why my eyes had been so dull and so inactive, and why I had not discovered them. Oftentimes I have looked for ten minutes to find a song bird in the tree overhead. And no man in a whole country can so successfully hide himself as can a little bird that has gone to roost for the night on the limb of a tree.

The squirrel and many of the bird tribe think that the dead limb knot-holes far up in the trees were made for their castle homes; and so they were. The decaying hollow log down in the swamp may hold, for all you know, an oppossum and all her family. And the innocent looking hole under the stump may be the home of a snake.

Nature certainly made all lower animal life to fit its environment, and made it especially with the idea of the preservation of life. It is hard for an enemy to distinguish the gray lizard on the old rail fence, or a "devil's horse" or katydid up in the green trees, or a bullfrog on a pond's bank, or a cricket on the hearth—hard, I say, to distinguish between object and environment.

Going over into the plant-world, there are also most interesting evidences of nature's desire to preserve and multiply life. Passing by many of these in trunk, branch, leaf, and flower, let us come directly to the fruit. We note that leaves fall to the ground soon after the seed-fruit. The rotting of these leaves creates warmth, and under a warm covering of leaf humus or mould the seeds sleep till spring. And note the protecting coverings of all seeds. No knight in his two-foot thick walled castle was ever more safe than is a chestnut or a chinquapin when in the closed bur. How indestructible is a peach kernel or a hickory nut or a black walnut, even when their outer protecting coverings are removed! In all of botany there is not a more interesting line of study than the study of primary and secondary coverings, or I might better say the inner and outer shells of seed germs. From the thick cocoanut husk-covering to the shell-like coverings of peas and beans, and the husks of wheat and corn and oats, and from the ebony iron of the cocoanut's inner shell to the shell of a tiny cabbage or mustard seed, there is a wonder all the way at nature's plan for life preservation.

I feel so assured that nature's creed is that "life shall abound and shall continue," that I am loath now ever to take life, either high or low. And

I feel always that to break so universal and great a law and to destroy even the germ of the tiniest life I must have the strongest of justification. Nature would not preserve life, if life *per se* were not sacred and holy, and if life did not have a right to a continuation of life!

To every man is given two lives to keep and preserve. Do we select suitable environment always and one most conducive to life, and do we hedge ourselves about with protections that can shield us? Or are we careless and indifferent and so open the gates to the enemy?

The scores of wrecked physical lives that one daily sees on the streets of a city—whose fault is it that they exist? For every wreck there must be a cause, near or remote. That cause, somewhere and at some time, was indifference to the conservation of life. There are not a few who seem unconscious that they have a bodily life to preserve, until by unlawful pleasures and indulgence they awake some day to find that they have forever lost it. And all that they can do is to take up and re-echo the cry of Dives in torment.

We, in all probability, have not the faintest conception of the preciousness of the life of our souls. For how can we yet know the full meaning of "life eternal" and of its bliss and glory and power

and peace. Viewing as we do this universal indifference to the preservation of the soul's life, the sight of the Christ looking down upon and weeping over Jerusalem, is of all things in the world the most natural.

XXXIII

SEDIMENT

THERE is such a thing, I am glad to say, in nature as chemical purity. Into all of the three states of matter—solid, gaseous, and liquid—this purity may extend. That there is not more of absolute purity in nature is largely because all substances of receptive qualities are so hedged in by extraneous matter. These foreign matters, from the standpoint of the substances themselves, are impurities. In the material world, most certainly, purity cannot touch impurity without consequent resultant defilement.

A goodly proportion of the impurity of running water is known as sediment. Sediment may be anything which, on account of its heaviness, settles to the bottom of our medium. It is also called lees, grounds, and dregs. It may be dirt, mud, trash, and various earthy matters, as washed up by the on-flowing waters, as they plough their

way through the soil; or sediment may be any substance which having been dissolved, is again separated from its solvents and is then thrown to the bottom of the vessel—a process known as precipitation. In all cases sediment is the impure thing, and it falls through inertia by its own weight and heaviness and grossness. This is God's way of clarifying, by natural causes, all the waters of this great earth.

The commonest example of sediment is to be found in those river bottoms that are subject to overflow. By means of rain torrents the soil of the hills is being carried down to lower levels. These varied impurities as fetched down, being separated from the main current of our swollen stream, spread out and are distributed among the quieter outlying waters, and there sink to the bottom as sediment. Such soils, built up by successive floods, are known as alluvial soils. The ooze and slime of all of our marshes is the product of sediment. All lake bottoms show fallen sediment, and there are ancient lakes all over the globe that have been filled to the brim with sediment and so have vanished, and whose sites to-day are only known by the character of the soil and sediment left behind. And out on the bar, the moving current of the river bearing silt, is met by the tides of the ocean and so stopped in its out-

ward course—at the bar sediment fairly rains down, and its rapid accumulations actually forbid commerce by rendering dangerous or impossible the world's navigation.

Few questions to the scientist are more interesting than is ocean bottom exploration ; and this too is largely a matter of sediment. Near the shore are found the coarser deposits from the waters. The farther out we go the finer grows the sediment ; and finally, far out in the deep depths we find in the sea's bottom no record of the shore, but only the marly, eroded, and worn remains of sea-shells—mostly the shells of minute animals.

Many water systems of cities that do not own filtering plants simply include settling basins, whose quiet waters are given days and days in which to deposit their sediment before being drawn off for drinking purposes.

And what is daily going on in the waters in the matter of sediment is also constantly true of that greater body above us of moving fluid—the air or atmosphere. Up into this atmosphere the winds, upward hot air currents and whirlwinds, are constantly sending all manner of dust particles from earth. Chemical examination of the air at various heights show a marvelous amount and curious variety of air sediment. These constantly, and more or less according to atmospheric conditions,

are falling down upon earth's surface. More quickly though than by gravity does a heavy rain sweep the atmosphere clean of its sediment.

And there is also sifting at all times through the atmosphere, thus constituting it too a sediment, what is known as star-dust. Upon the bottom of mid-ocean star-dust, in no small quantity, is to be found to-day, having fallen quietly and silently for millions of years out of the skies. This is, perhaps, the ashes of burnt-out stars and of meteors consumed in our atmosphere through friction. There are probably some tons of this each year deposited upon our globe.

What a miscellaneous and heterogeneous mass is this dust of our earth! We find that it is the principle of sediment and impurity in all the states of matter. We breathe it, we drink it in our water, and we eat it in all manner of ways in our food.

You will always find sediment at the bottom. It is the ooze and slime and lees and dregs of all the kingdoms. Sediment everywhere is always falling to the bottom. In quieter waters it falls quickly; in the rapid current it may be borne out to sea, but only to meet its fate at the bar. It fills up rivers and streams and inland lakes; it impedes navigation; and little by little it is filling up the depths of old ocean itself.

That which everywhere makes a thing fall is its own sheer weight or inertia. If it were not heavier than its medium it would float forever! Analyze sediment in the trodden roadway, in the lower air strata, and in the sea, and you will find here the lost remnants of things that were once shapely and beautiful—dust and ashes, the ground-up fragments of rocks, tiny bits of vegetable fibres, and even the last and sole evidences and traces of a star.

The great question of to-day, my brother, in this day of great problems, is not if we shall circumnavigate the air, or send wireless messages over and across the waters or straight through earth. It is not if we shall talk to Mars; it is not if we shall convert coal directly and without loss into energy; these things are trifles as compared with those questions that appertain to that which we shall call the dregs and grounds of humanity.

It is this sediment that fills our jails, our penitentiaries, and our chain-gangs; it is this sediment that makes the policeman ceaselessly walk his beat; and it is this that puts locks on your door and mine, and bars across our windows.

There is study enough down in this sediment to interest every sociologist, every humanitarian, every Christian, all the days of their lives. Our scientists and explorers and mechanical and elec-

trical geniuses are peering and prying into every dark corner and crook and cranny in nature and flooding it with sunshine. But who is giving heed to and who is caring, save God and the angels, for this teeming under-world of humanity—this "submerged tenth" of our race?

XXXIV

THE CLINGING ONES

F all the families to be found in the vegetable kingdom the one that appeals most to my sympathy and to my heart is that of the climbing plants, the clinging ones. Too tender and delicate, too attenuated and frail to stand up alone and face the battle of life, the Creator has given them the disposition and the ability to cling to that which is stronger than themselves.

By this adhesion, and cohesion too, I might say, the little plant receives untold strength from its able life partner. Storms cannot separate them, for their bond is well-nigh indissoluble. They live their happy lives together. And many a time have we all seen cases when the strong partner having died the little plant still clung to it and lovingly hid all marks of decay and death by its own beauty

and by its own fresh green life. The climbing plants are nature's own exquisite draperies. They repay a thousand-fold everything that befriends them. The proudest cathedral of earth feels honored and enriched because of the ivy that covers it. I have seen the lordliest and sharpest and most defiant of mountain crags softened and made things of beauty by the vines that clung to them and covered them over. I have seen acres and acres of tallest, stoutest forest trees wreathed to their very tops with a soft green beauty of clinging vines that no mortal hand could have equaled.

The tiny sea-weed that covers a wandering sea-shell, the moss that covers the stones and the roots in our pathway, the trumpet vine that vestures and hides the ugly stump of the tree that was felled, all have their artistic places. How without them could nature cover her waste places and her own uncouthness and decay?

And what marvelous, wondrous means do some of this tiny family use in order that they may attach themselves to their strong supports! The grapevine uses tendrils as strong as steel that enwrap themselves over and over again round about the stakes and cross-arms. And the strength of three or four men would not suffice to tear this grapevine from its support.

Some vines wind their whole bodies about their supporting friends. Some climb from right to left, others from left to right. And no human skill can make a vine climb in a direction contrary to that taught it by nature. Others have a little foot that attaches itself by suction, like the foot of a fly. These can climb up perpendicular glass, or the smoothest wall. As if one foot were not enough, others have several tiny fly feet; and the vine itself will tear and break sooner than these will lose their hold. Some have the tiniest rootlets that go into and fill up the crevices and thus hold fast. Some climb about their protectors in such a riotously loving way that we name them "love in tangle."

To climb and to cling is the salvation of all of these. If they failed to climb and failed to cling they would in their own structural weakness fall in the trodden paths and be crushed and lost. But in their weakness God gave them means for strength and a way of salvation.

Up higher and in the human world we also find weakness. We find tender, shrinking, fragile ones who seem without ability to stand by themselves, and for themselves to make their way against the storms and adverse winds of life. But God has not left bereft and comfortless in his kingdom the

tender and gentler ones. In the tiny arms that cling to its mother's neck the little babe brings to its aid the strongest of all human powers—a mother's love. The arms of the babe and of older children thrown round about and clinging to parental love make childhood well-nigh as safe and secure as are manhood and womanhood.

In this self-same way God has pledged all the strength and all the power of heaven to the human being that clings to him—"*Teneo et Teneor.*" It is not by strength and might, it is not by social power and wealth, it is not by wisdom and fame that we are to obtain these almighty blessings, it is simply by the act of clinging.

What comfort does this bring to the weak ones, the timid ones, the little ones, the uncared-for ones, and the bereft ones of earth! Clinging was made for just such as they. They have not the power to do aught besides cling. And so it happens that the strength and comfort and peace of heaven are found more often in lowly hearts than in lordly hearts, more often in the hut than in the palace.

There may be those who think they are strong enough of themselves to stand up alone and face the duties of life, and after life to look unflinchingly into the realities of the future; there may be those who would measure their strength with the strength of God. To these, storms and whirlwinds

and cyclones may have to come before they comprehend their own weakness and before they stretch out their arms and clasp him who has said to all the world: "Come unto Me!"

XXXV

CHLOROPHYL

THE structural unit of all life is a tiny cell; farther than this cell you cannot divide cellular tissue. These cells may have cell walls, or there may be simply a nucleus surrounding its individual mass. The contents of this cell is a semi-fluid called protoplasm. Plants manufacture this protoplasm from minerals and from the atmosphere, under the influence of sunlight and heat. This protoplasm is the primary form of life; it is the physical basis of life. Within this cell-protoplasm float tiny granules. They may be united, star-shaped, or in chains, or each one may be but a rounded particle. They play an important part in the food assimilation of the plant. In looks these granules are like a waxy pigment. This pigment, itself a mixture of yellow and blue colors, is always green in appearance. It is the formation of this pigment, in all plant-cells each spring, that makes that verdure which greets our

eye in the field and forest and over hill and dale to farthest horizon. Not only to the presence of this pigment does each leaf and stem and blade owe its greenness, but some of the lower animals owe their color also to a similar pigment.

This green coloring-matter cannot be developed except under the action of light and heat. Under the influence partly of cold this green pigment is broken up and dissipated and changed within the fluid-protoplasm, and lo! we have the whiteness and that seeming death that are incident to winter. The gardener, when he banks up his celery and ties up his lettuce leaves, banishes the sunlight and so dissipates the chlorophyl, and so produces these blanched and whitened vegetables. To tear away the earth in the one case, and to untie the leaves in the other, would bring back the chlorophyl in the leaves and stems of both plants.

Where plants languish under disease they are always pale through loss of chlorophyl. Within the cool dark shadows of your living-rooms most plants will soon languish, whiten, and die. As between the lower and higher types of plant life, there are wide variations of chlorophyl distribution. The lowly mushroom is destitute wholly of green herbage. The upper sides of all leaves, and this is the most important side of a leaf, contain in their cells far more green pigment than

is contained in the cells in the under side of the leaf. The upper side is therefore the greener. The older the leaf—till the autumn tints appear—and the longer it has been exposed to sunlight the deeper the green of its leaf, while young leaves look almost white.

There is an infinite contrast in the shadings of green in trees and plants. No two seem alike. To each plant type nature makes a specific assignment per cell of chlorophyl. As a metal is known by the color of its spectrum, so in a healthy plant you might almost discover and individualize the plant, if you only knew the amount of chlorophyl, and its shape, within one single cell of its leaf or stem.

Than green there is no other color so pleasing to the eye. I believe the world would grow mad, and there certainly would be continual pain of eyesight, if all of our living green were changed to yellow or red. To look out upon nature's greens brings ever deepest rest and refreshment.

To put life into death, to put this saving green into whiteness, this is the part and work of chlorophyl. A plant cell is a tiny thing,—the tiniest living structure in all of God's material kingdom,—but through the advent each spring of chlorophyl into the infinite cells of all plant life this great earth, from cold white and wintry death, is trans-

formed into an Eden meant by God to be a type of that paradise where angels ever and evermore dwell.

There is in the human being that which is akin to chlorophyl—we call it love. It can be developed, or it can, by the lack of sunshine and warmth, be made to grow pale and sickly and cold, and so be made to die.

What else in the world is so wonderful as is this love-chlorophyl? What else so puts strength into the arm of weakness? What else so fills the world with brave-hearted men and women? What else is so potent to make men risk their lives, aye, to give up their lives?

We never tire of beholding love's works, whether it be in storied page or in whatever place wherein men toil and strive and dare and suffer and do brave deeds.

Put love into every protoplasmic cell of your life. How beautiful is the green palm in the desert, or how beautiful, winter gone, is the green of the grass, the shrub, or the tree!

Heaven is a place of eternal sunshine and warmth. No shadow and no cold is there, as on earth, to dissipate chlorophyl. Every prospect there forever pleases the eye. And there the heart will do and dare with a courageous strength

unthought of on earth. And love there will not pale and grow cold, nor will love there ever die. In every protoplasmic cell in heaven chlorophyl is irrevocably, unchangeably, eternally fixed.

XXXVI

THE WARPING OF TIMBER

A SAPLING is a young tree, and full of sap. No one would ever think of making lumber out of a sapling. The pity is that there are old trees that never get out of the sappy stage, and the lumberman wonders why such trees were ever made. Along most of our great rivers are wide stretches of forest. The timber in them, surcharged with water, grows to immense size. You might think this would be the saw-mill's paradise. But kiln-dry such wood as much as you can, and beams, rafters, planks, boards, etc., made of it will, if used, crawl, shrink, and warp. You might say that the durable cypress shingle is an exception, since it is so largely used. As a matter of fact, this shingle warps more than pine, and it takes two nails to prevent warping to the pine shingle's one.

An architect would not dare specify other than heart lumber and kiln-dried. He might go farther,

and specify that it be winter-cut (in the forest) and two years dried.

It is the tree's heart—drier, denser, closer-grained, and of harder wood—that the sawyer in the mill is getting after as he mercilessly tears away the surrounding and outside green boards, soft, soggy, and full of sap, and so puts them in the trash pile.

Warping is the unequal contraction, through drying out by heat, of wood. A log, a scantling, a board, on the ground, will crawl, creep, crack, curl up at the ends toward the sun, and do all sorts of funny things. Its top surface, it is plain to see, has more heat applied to it than has the cool, damp bottom surface.

In a kiln a gentle heat is applied equally to all parts of the timber—no two parts of which touch—and so the drying out process is equal on all sides.

To prevent columns for pillars from cracking, as they so often do, the lumber people bore out the heart of the log, in order that contraction may be equal inside and outside.

Lumber, in a lumber yard, is always piled high in piles. This is not to save room. It is to save warp. As it is, the few top boards will always curl up, warp, and split. The lumberman, by the way, in fixing his pile, lays sticks between the

planks; they would not dry if they touched, moreover they would get the "blues." I cannot say whether this "blues," so prevalent in lumber, is a fungus growth or a chemical change in the sap. But it permeates the wood, and you cannot saw or shave it out. It stains to the heart.

One of the purposes of paint, shellac, wood fillers, hard oils, and varnishes, is to prevent warp by preventing the entrance or exit of water or sap. The hard woods, and free of sap and warp, are daily becoming more sought after and dearer. The cabinet maker, the house builder, the car builder, the bridge builder, and all other wood artisans who have a care for their reputations, will only use those woods that will stand the wear and tear of heat, cold, and damp, and indeed all the stresses of varied weather.

It is worth while in buying a house, or even a bit of furniture, to have a care that you get just the right kind of wood. For a drawer, a pillar, a door, a window, or a wall, once warped, is out of plumb forever. No carpenter can renovate it and keep the same wood. Like men with rheumatism, warped woods are always worse in a "wet spell." In many a home, a few damp days will lock up, as with a key, every drawer in cabinet or bureau.

Unfit for lumber and unfit even to burn for firewood, one is apt to wonder why in nature's econ-

omy sappy and easily warped woods were ever made.

No one expects children to be capable of consecutive and consistent thought and work. We expect them to fly off at all sorts of tangents, and to be full of vagaries. Their minds and spirits are not mature nor by any means developed. They are in the sappy stage of life—indeed are saplings, and need a world of growth of grain. While we hope for each one that his out-turn may be like that of red wood or hickory or oak or mahogany or teak tree in the forest, yet we know that many will be sap heads and will remain silly all their lives, and be therefore of as little use as are the swamp trees, that never lose, even by fire, their sap. Such people take on a new warp more often than the moon changes, and the man who tries to build edifices with them will have a condemned house on his hands.

And the man who is full of prejudices and whims, the cranky man, and the man who goes round pluming himself on his eccentricities, these too, all have cases of the "warps," which is unequal expansion. The heart is as easily warped as is the brain, and unless these two at all times expand co-equally, the result is surely a warp. The university is not exempt, neither is the pulpit. The pews

are full of it. The religious crank is no less a crank and a warp because he is a church-member and thinks he is doing right.

The sap will never get out of the world till the millennium comes. The spiritual lumberman in the next world, where all the timber is hard grained from center to circumference and without sappy conditions, will think that he indeed and in truth is in paradise.

XXXVII

DORMANTS

SUSPENDED animation, or an apparent suspension of vital action, in an object which, for the time being, seems neither dead or alive, is one of the most interesting of all phenomena in animal or plant life.

The withdrawal of necessary stimuli often causes this condition. Seeds, deprived of moisture and air, have been known to preserve their germinative power hundreds of years. Certain fishes in Ceylon bury themselves in the mud in the dry season and return to active life when the rain comes. Certain animalcules, deprived of moisture, become dry and remain dormant indefinitely until revived by moisture. Diminution in

temperature will induce this phenomenon. Cold-blooded animals can stand almost any amount of cold. Frozen fishes have been often taken from water and revived. Frogs and snails have been kept in an ice-house three years, and yet have not died. Warm-blooded animals, on the contrary, when subjected to suspension of vital activities die.

But these things are not half so interesting as is the phenomenon of hibernation (going into winter quarters), so common in a goodly number of cold-blooded animals in cold climates. (Down in the tropics certain animals have their season of lethargy or deep sleep in the summer time.) Such animals as bears, bats, badgers, hedgehogs, lizards, snakes, land-snails, eels, mussels, and many insects hibernate. All country boys know a great deal about the annual sleep and awakening of the dormants. Looked at from a lazy man's standpoint, it is not so bad a condition. There is nothing to be done except to curl up and sleep; no eating of food, nor drinking of water; no walking about; no worry and no fretting.

This condition is not confined to animal life. The trees of the forest, bereft of foliage, stand practically dormant in winter. A large number of plants with bulbous, fleshy roots die down, so far as their tops are concerned, when the fall comes, putting out new shoots in the spring. Of course,

though, the great hosts of plants are like the warm-blooded animals, and actually die so soon as there comes any practical suspension of vital actions.

By far the most important phenomenon connected with the dormant state is the decreased respiration. In all cases where there is normal or rapid respiration in animals or through foliage of plants or leaves of trees, there must be constant feeding to take the place of the waste products given out through the breath. The respiration of the dormants in a dormant state is so insignificant that one may be immersed in water or poisonous gas for quite a while and not die.

Now here is an interesting law by which nature seems to keep up a certain equilibrium: by as much at any time as is respiration decreased, by so much is nervous irritability increased. The dormant, when cold weather comes, will creep off into holes and crannies, etc. The general belief is that they do it to keep warm; but they do it largely that they may not be disturbed. This precaution is necessary, for it is an easy matter to kill an animal hibernating by arousing him and worrying him a bit. Being already in a highly nervous, irritable state, a slight increase of this condition (an over-stimulant) often kills.

An interesting phenomenon among animals of

habitual low respiration (dormants) showing high nervous irritability is their long-continued muscular twitching after being killed.

A parallel to the above is not hard to find. I refer to that great host of human beings in whose spiritual and mental lives there is almost a total absence of activities. I do not refer especially to the serious and flagrant law-breakers, but to that large class of men who do not grasp opportunities, or make use of advantages, or who do not use their gifts as they might.

There are sleepers in the Church and in the State, on the farm, and in business offices, and also in the professions. There are sleepers among those to whom has been given great wealth, and there are sleepers just as dormant down in the humble cottages. Nature is kind to her dormants in holes and nooks and crannies. In the spring she calls them, and every one comes at her bidding. But who or what shall awake our human dormants and call them to life's full activities and responsibilities?

The very best men have lapses. Fortunate is that man who before it is too late, awakens to duty. And happy should be that man who, by appeal or example arouses one single soul out of its lethargy.

It is a strange fact also that among the human dormants those of slowest moral respiration show highest nerve irritability. I know a man who is a murderer, a drunkard, and gambler, and who all of his life has been a tough and a lover of fights and quarrels. And yet that man said to me lately: "I don't see why some people seem to dislike me. I never wronged them. I love peace. I never injured any man in my life." What extreme hyper-sensitiveness of epidermis did this tough show! The worst gamblers and blacklegs of any city are the ones who make the most positive and most frequent assertions that they are "gentlemen."

Make the most remote reflection upon the integrity of a Western plain bully, and he will plug you with a bullet. Nothing less than a wise man can receive reproof. Nothing less than a saint can say, "I am the chief among sinners."

XXXVIII

WINGS

SOME years ago, in Switzerland, I stood on a precipice of an Alpine mountain. There was before me a sheer declivity of three thousand feet. And though I stood some twenty

feet away from the brink, yet when I looked down into that awful chasm, I felt my whole frame a-tremble. All at once a little bird, just ahead of me, flew off the mountain. He played in the air, and then in wide circles climbed higher heaven-ward. I do not know if he was unconscious of the great distance beneath himself, or if his mounting higher and higher was done to exhibit his fearlessness and to show his absolute disdain of earth. As he left the mountain-side, I involuntarily put out my hands, thinking to stay him, fearing that he would fall and be dashed to pieces. But in a moment I was laughing at myself as I said, "Why, he has wings!"

Wings are those agencies by which a body can raise itself in air and sustain itself there, or move forward in any direction. Science stands helpless and without explanation, as she views all of nature's winged bodies. Man's best steam or electric cars or bicycles fade into utter nothingness beside the simple flight of a bird, a bee, or any one of the tiniest insects that fly in the air.

Wings have little place in the city. They need airy space, they court the illimitable ether. Go out in the fields some day, you who live in the country, and watch for an hour the ten thousand wings about you. See the buzzard, far up in serenest heights, sailing through the livelong day

without perceptible motion. See the dove's rapid flight, the see-saw flight of the woodpecker, the fluttering flight of the field lark, the noisy flight of the partridge, and the short, twittering flight of the field sparrow. Watch the flight of the myriad of butterflies, all robed in bright array! Watch the buzzing flight of the grasshopper host that spring up at your feet! Watch the quick, straight-lined flight of the bee, so full of business and honey. Watch the flight of the fiery wasps and hornets and of the peppery yellow-jackets and of that blundering blunderbuss, a bumble bee. Watch the flight of thousands of tiny insects in the air about you, the motion of whose wings no human eye has ever discovered.

Look close about you a-field, and you will see that even the things we call inanimate have wings. Watch the wings that all the thistle tribe put upon the seeds that they bear. Watch the flying cat-tails in the swamp, or the broom-sedge on the moor's edge. Examine all the seeds of light weight, and see to how many of them God has given feathery wings that bear them hither and thither.

And how tireless those wings are. A bird's wing-muscles are a hundred times proportionately stronger than are the arm muscles of the strongest man. Look at a swallow's wing and you will find

that it covers almost as much flat surface as does the foot of a one hundred and seventy-five pound man. Put that swallow, that verily lives in the air, in his ethereal element; watch him sailing, circling, and dashing with many circumvolutions through all the happy day; he seeks his nest at sundown, after his one thousand miles of aërial travel, not because of weariness, but only because night has come!

When out in mid-ocean, one thousand five hundred miles from land, when the water is more dull and dreary and lifeless than the Sahara Desert, how refreshing to see the little stormy petrel skimming along the pavement of the sea! On shipboard, one wonders as he sees him flying and flying and ever flying in that wildest, loneliest, and most dangerous of places, one wonders, I say, at the tireless power that lies in those tiny wings!

And the beauty of wings! Did you ever look at the colors on a dragon-fly's wings, and especially upon the wings down in the swamps of those fellows whom children call "snake doctors"?

And butterfly wings! Did you know that a butterfly's wings are made up of a host of minute, colorless, overlapping scales, and that the color of the wings is caused by the interference of rays of light along the edge of the scales, precisely as are made the colors in mother-of-pearl? The most

wonderful sight I saw at the Philadelphia Centennial were the wings, through a microscope, of the *coleoptera*, or hard-backed bugs from Brazil. It did seem to me that a whole aurora borealis had been emblazoned on the back of the bug! And I thought then that if God had stooped and painted with such care all the colors and shades of his rainbow upon a bug's back, I would never more call anything of his lowly or mean or insignificant.

You and I live in a world that is heavy and earthy. The force of gravity bears everything downward. There is sorrow here and grief and poverty and there are tears. There is loneliness here and sickness and despair. But as wings can bear us up against gravity, so can wings bear us up against grief and tears. We cannot always actually see these wings that bear us up; yet the most and the best and the most real of the things in this universe are things we cannot see. We cannot see the wings of prayer, the wings of faith, the wings of thought, the wings of light, the wings of the wind; but they are there.

You never gave a barrel of flour, a ton of coal, a warm garment, a word of sympathy or of hope; you never brushed away a tear or smoothed out a wrinkle, but that you were giving to some one wings that bore him up above his sufferings. The

angels of heaven are not the only angels, and their wings "with healing in them" are not the only wings. Kind hearts can make everything about them grow wings. The doing of good bears no relationship to social position. The *coleopteran*, with the aurora borealis on his wings, is the bug under our feet!

XXXIX

NATURE'S VOICES

NATURE is audibly speaking all the while. If our ear were sufficiently delicate, we could place it to the ground and hear the gigantic monotone rumblings proceeding from millions of sources within a never-quiet earth; we could hear the rumblings of distant trains and wagons and footfalls on its surface; we could hear the roots of the trees creaking down beneath the soil; we could hear the song of the grass as it grows, and the song of the growing corn in yonder field, and the song voices of the ants in the dust, and of the crickets, and of all tiny creeping things.

I would not dare say that God in the beginning made one thing in all creation that was dumb and could not sing, if it chose, its own song of glad-

ness and of thanksgiving. And though some of these songs may pass your and my finite ears in their upward passage into the great resonance chambers of heaven, yet God there surely gathers them up, as I believe, in great consonant anthems, and from his high throne answers back the singers.

Few things in nature can sing more songs than can the wind, each song and keynote being indicative of its mood and spirit at that particular time. The most terrific note I ever heard was the fierce, shrill, titanic shriek of a cyclone, not two hundred yards away from me. All of that evening thereafter the clouds dashed hither and thither without aim or drift; the wind came and went in gusts from every quarter, and all the night long I heard it, moaning and moaning as if it were some human being crying for the harm he had done.

There are few things of greater interest than to go out into the open, and there, listening at every sound-voice that you hear, argue back to the quality of the spirit that inspired the note. Have you ever heard the storm-waves beating and bursting in their rage upon the shore? And on a clear, calm day have you heard the waves lapping so gently and quietly upon the self-same shore that their sound would not awaken a sleeping child? The roar of a Niagara has a different keynote

too, from the little brook as it sings and plays with the pebbles and stones that lie in its current. The coo of a dove, the bright song of a canary, or the hungry cry of a hawk, or the uncanny hoot of an owl at night, these all indicate the varied tempers or spirits of the birds in question. A dog's note when he is on the trail, or when he is at bay, or when he notes the approach of his master, or when he is engaged in a rough and tumble fight, no two are at all alike. What a study of keynotes would one have, if he could live a month in some strong, safe, iron cage in the center of some unexplored forest of Central Africa, or jungle of East India, full of all manner of wild and ferocious animal life. While our ears are not attuned so that we can distinguish the varied accents and notes of the same cricket in the grass, or cicada in the tree, or the various notes of all the insect hosts, yet with many of them we can get enough of their general voice-tone to arrive at the spirit-trend of the little animal.

Voice in nature is everywhere the expression of, or utterance of, soul. Voice is dual; the inner sentiments and outward expressions are one and the same. Nature everywhere and at all times is giving utterance, and all utterance is according to the above law.

There is no such thing as noise, in its generally

accepted sense; for noise is chaos, which is a senseless thing. All noise rather, is voice, and all voices are full of meaning. It is easy enough to look upon all nature about us as being a dumb, dead, material, unmeaning thing. But heaven did not so intend it. Heaven never made a dead thing. It is part of the record that the flaming stars and all the material spheres in the zenith sing as they roll in their orbits.

Nature is talking, talking, singing, singing, to all the world and all the time. Each voice has its own spirit, and to him that hath ears that hear, the realm of nature all about him is as full of spirits as are the realms beyond the stars.

That soul of yours is talking, talking, singing, singing, to all the world and all the time. It could not be voiceless if it would. More than you or I think does the very keynote or pitch of your daily voice, to say nothing of its rhythm and metre and accent and emphasis, indicate the quality of your soul.

The voices of cyclones and cataracts and booming surf and hungry hawks and roaring lion and snarling jaguar, these all have their counterparts in the human voice, and in each voice we see the audible photograph of a soul.

"Peace and good will" the angels' sang. And

they sang it on earth. And God for this earth meant that after that night there should never be uttered by mortal man a note more harsh and cruel and fierce and selfish and shrill than this. The keynote of the angels' voices was to be the keynote of all humanity; and the human soul from which the human song came was to be as sweet and pure and gentle as that of the angel.

Nothing can come into heaven that defiles it; and so it is that no harsh and cruel notes of yours and mine can ever come up into heaven's resonance chamber where is gathered, for angel and redeemed, the sweetest music from all the worlds. But if God were to bend down his ear to earth's level and listen, and if voice is dual and is the expression of a soul, then what a poor opinion must his analysis give him of some men's souls!

XL

COMPENSATION

THE more a man knows of the underworld life the less boastful and less disdainful he becomes. God in creation seems to have left no life comfortless and bereft. Wherever certain powers seem to be lacking in any one creation, one has only to examine closely to find

other powers developed to an exceeding high degree. It is only the ignorant man that to-day, putting his foot upon the life under him, can call any part of it unclean and mean and ignoble.

I have been awakened many a morning at the crack of day by a whirr and a whirl and by a cackling song, and I knew that my house lodger, the chimney swift, had started on his merry rounds for the day.

My eye has followed him hour after hour, wheeling and circling and chattering, far up in the glorious sunlight in the empyrean blue. Did he tire? Did he faint or fall? What man in all earth could do for one moment what that tiny bird does through the livelong day? Not more wonderful in all animal life is that power of the dog by which he can discover in the crowded street the direction in which his master went, or can detect far out afield and at a great distance the presence of game.

No less a one than our Lord, in no less a book than the Bible, has contrasted for man the beauteous garments with which the lily of the valley is arrayed. Wherever we turn, wherever we look, man can find a wonder and a marvel in all the life about him, and see gifts which nature did not see fit to endow him with. The more we look into creation the more does it seem that God's plan is one everywhere of divine compensation.

The most pitifully helpless thing in all of human life is an orphan child. But turn with me into the insect world. We find at its threshold this fact, that nearly every insect is born into the world an orphan. Do they die? Break into a little clay house stuck to the wall, break into any of the curious closed-tight cells of many kinds where are insect eggs. The larvæ when born find food just at hand, left by a careful mother. Or the egg may have been left somewhere in a sweet nut, or a peach, or a grain of corn, or on a cabbage leaf, no matter where. Wherever the grub is born he finds food to be had for the eating. And he lustily lays to at once and without coddling or formality.

Now if the theory of compensation be true, then the lower you go in the scale of life the more wonderful should be the compensation that we find. The lowest thing, perhaps, in plant life is the lichen. You have seen them all your life—flat, leathery growths, mostly on barks and fences and rocks. Yet this is the most widely diffused plant in nature. Some of them love the moist bark of trees, and some kinds love the smooth, dry bark. Some love the wet rocks, while some love dry rocks. Some love the rocks and sands of the hottest desert. Some love the coldest climates, as do the Iceland moss which we eat,

and the reindeer moss, on which reindeers largely live. Some kinds love a granite rock, while others cling to limestone, and still others to sandstone, while there are some kinds which spread themselves at once over the freshly cooled lava from a crater's mouth. They show all colors and perform faithfully their own simple work, for the gray and green and yellow and brown and silver and gold patches of lichens on the rocks were not put there only to cover nakedness and barrenness with color and beauty. The roots of the rock lichens go down into the tiniest crevices and the plants cover the hard surface; these attract and gather the moisture of the air or rain and hold it there. And then begin through their united agency the silent disintegration of the mighty rocks which are to furnish with fresh soil this great, wide world.

But there is seemingly another and very wonderful compensation given to this lowliest plant, and its parallel is perhaps not to be found in mortal life. The strange thing is that this lowly plant should show such marvelous vitality, so much and exceeding great life. You may keep a specimen in a dry place in your house for a year and then put it out in the moist air, and it will relax and begin again all the functions of its life. The vitality of the lichen is such that it is believed

that it would live, if unmolested, ages upon ages—thousands and thousands of years. Indeed, the great botanist, Fries, is quoted as saying that "the life of lichens bears in itself no cause of death, and is only to be ended by external circumstances."

Think of this tiny, lowly plant, O boastful man, that seems to have been given the power within itself of living, if undisturbed, till the trumpet sound on the last great day.

Where in all nature can you find kinder and greater compensation?

The New Testament does not abound in commands. But in it is to be found one dreadful warning that we are not to judge our neighbors. Perhaps a reason is to be found just here in this theory of compensation. Perhaps your neighbor may have his shortcomings, as you think. But perhaps if you knew your neighbor better, knew him as God and the angels know him, and knew of some exquisite divine compensation that God had given to him especially, then in place of judgment you would be glad to fall in the dust at his feet and do him reverence.

God has not left his people bereft and comfortless. Whatever the short-lived gifts of earth may be, God's gifts to his children lie along the lines

of the immortal and the eternal. Even the gift that seems temporal, in God's hands shows eternal uses and purposes. O lowly men and women of earth, seemingly shut out from power and wealth and social position, go search, and you will find that which will be for you God's glorious compensations.

O men and women of earth who though in the following of Him may have to forsake some ways that look pleasant to your eyes, yet it were better to search and find him out who, pointing to a new way, holds in his hands divinest compensations—the riches of truth and life.

XLI

STRENGTH IN CALMNESS

WHEN the world's artists have wanted a study of tranquillity, calmness, and peace, they have always sought out nature; and for this study they have painted and photographed it in unnumbered ways and times. Whenever the artist has looked out upon its natural self, and not its unnatural, the pictured face of Buddha himself could not show more of calmness than our artist finds in the face of nature. Sometimes upon a quiet afternoon as I have looked upon a forest, or

a harvest field, or an emerald meadow, the thought in my mind has been of even more than that calmness—it has been almost that of repose and sleep.

See how quietly the spring comes on; not a bugle note is sounded; there is no impressment of railroad trains and steamer transports; there is no massing at great cost of immense trains of quartermaster's stores, there are no drill sergeants nor daily drills nor large staff of commissioned officers; and yet all the armies of the world, from the beginning till now, would not compare in numbers with the recruits of leaf and flower and blade that fall into ranks with each incoming spring, on tree and vine and bush as found in one single forest. If in all this marshaling of numbers there is ever one single command given, it is in a still, small voice too low for human ear to catch.

In all of human endeavor and struggle, there is nothing to compare in strength with spring's vital force. We have often seen in the garden a little bean or pea stalk just coming up, raise a clod of five hundred times its weight. I have seen a thing as soft as a mushroom raise a heavy stone; and it is on record that three mushrooms have lifted an eighty pound stone. Scientists have harnessed a growing squash fruit, and it has burst the harness and gone on growing. It is said indeed, that a squash's force of expansion is five thousand

pounds. Now multiply the power of expansion, in all the fruits and flowers and stems and leaves, by their own infinite numbers as seen each spring and summer in forest and field and garden, and we would find our mathematics swallowed up in the figures that would note the result. This result would show the force expended by spring in order to give this vernal loveliness which everywhere greets our eye, and would show the power put forth by her in order to fill the world's granaries with food.

The quietness with which all of this is done, I say, is the world's greatest marvel; and yet if it were done in any other than in a tranquil, calm, and quiet way, there would be danger in the result. For whenever one hears noise in nature, he is apt to find that there has been a clash in some of its laws. We will find perhaps a titanic struggle between opposing forces and consequent destruction and maybe death. The shriek of the cyclone, the crash of thunder, the roar of the storm, and the boom of the breakers off shore, these all speak with loud and startling tones; and they are the tones of fury and of gigantic brute force, as inimical to all the quiet work of nature as they are to humanity and its work. And yet these terrific sounds are almost the only loud sounds known in nature.

For the fret and worry and turmoil so incidental to the business life of to-day, there is no better antidote than the placid calm found in the country. I have never known a merchant, grown tired of the strain of business, but who hoped at some time to be able to quit the city. The medical profession long ago found out the tonic that is to be found in the country, and it yearly sends there a great host of weary, nervous, and weak persons, to get strong and healthy once more.

At all points we see that calmness is necessary for strength; strength for initial growing and strength also for recovery. The noise that passion and madness give vent to, in human life, shows a clash of opposing forces. In the pathway of passion is destruction that oftentimes is equally fatal to both combatants. The ancients rightly defined anger to be nothing less than a short madness. Constructively considered, passion, ferment, and fury are always weakness.

Calmness is necessary if one wishes to retain his full nervous bodily strength. He who would win his point and gain his case in whatever struggle he may contend, must hold fast ever to calmness. Noise and frenzy and passion we expect in the savage. The farther removed the man from the savage, the more even and smooth and calm and temperate should be the quality of his life.

Just why a cataleptic fit or its equivalent should be the necessary concomitant of the dawning of the religious life in a man, I cannot see. I can conceive of better Christians than the howling dervishes! The mind should be the balance wheel of the heart. I can understand why a Christian's heart should be especially exuberant, but there is then all the greater reason why his mind should be one especially wise and comprehensive and calm.

We want to grow in our religious life; we want to make the most out of it and do the most that is possible in it. For all of this we must, unless my parallel fails me, have calmness and serenity and quietness of mind of life and soul.

XLII

BARRIERS

THERE are many things and conditions in the plant world that are of intense interest to the Christian socialist. Down there, there are four great gifts that are absolutely free to their dwellers. There is this broad land, whether it be on level plain, or sunny hilltop, or in rich valley. It is theirs to choose from, and it is theirs to flourish in and to bring forth fruit in.

And all air, water, food, wherever found by them, are likewise free. God gave them these things, and he holds the titles for them against all marauders and thieves.

The conditions down there remind me of the kind of a heaven which George Macdonald has pictured, viz, a place where everything is absolutely free—where every man produces those things he is best fitted for and loves best to do, and where the product of his toil is freely given to all others, just as the product of their toil is given to him. If we say that this picture or vision is strictly supernal, then we must admit that this lower vegetable kingdom beneath us conforms more closely to celestial types than does this lauded lordly kingdom of our own.

Besides these free things which are theirs by simple appropriation, I find also down there no impediments in the matter of environment. There are no barriers set up. No plant says to another, "I am holier, wiser, better born, more useful, more beautiful, than you." There are many that might claim royal succession, many that might claim membership in the Mayflower Descendants and Colonial Dames and Daughters of Confederate Officers' societies, but you would fail to find any of their autographs in any of these records. The grand oak and the scrubby old field pine grow

up side by side and all through life lovingly touch elbows. No shrub or brush or tree ever cast off the tender vine that clung to and grew about it. No rosebush ever said even to a nettle as they grew up one beside the other, "Go away, depart from me, you hurtful, stinging thing." No holly, or cedar, or magnolia tree ever said to its tiniest neighbor annual, "Stand you afar from me, for I belong to the evergreen—the immortal among plants."

The blessedest, best picture of peace and goodwill in all this green earth is down in the warm, damp, rich jungle where plant life consumes the time in absolutely riotous living. But everywhere there is happiness and joy, everywhere they meet and clasp hands, which is the seal of universal brotherhood.

Nature never makes a barrier. The rivers are simply highways to the sea, and the seas are the world's easy highways for universal free commerce. The mountains are simply places of elevation on whose tops are the purest air and the most abundant sunshine; and the tallest mountain-tops are simply places of earth, around which heaven can safely place her eternal snow mantles—white because they nestle up so close to the throne.

And he who loves nature and sits at her feet, and yet has not learned freedom and companion-

ship, and who has not learned to hate shackles and barriers—then he has not read in the sunlight and aright her meaningful lessons.

What pitiful barriers poor humanity is constantly setting up! Pitiful because they are unworthy, and because they shall be broken down at the last. There is, in point of fact, no room in all this earth for barriers of any kind. Should perfection separate itself from imperfection? The Christ—and whenever we want to find an example for man, how we are compelled to go back to the divine man for it—the Christ had all the known high and great qualities. Did he build a barrier about himself? On the contrary, there was never a man so approachable. As he came to all the world, so all the world could have come to him—yesterday, to-day, and forever—in a frank, open-hearted way. There are many things which Christ did not mention in his Sermon on the Mount which are nevertheless set down among the "blesseds" of earth, and which are, every one of them, barriers. The aristocracies of wealth, fashion, society, and power are not agreed among themselves as to which is the best. They are cold and cruel among themselves and to all the outside world. Each aristocracy draws a circle about itself and hangs out a sign, "*Noli me tangere.*"

Shall we not have pity for the things that one day shall be dust? There are things that are eternal because they are glorious and grand, and because they are true and beautiful, and because they are too precious to be lost. All of these things will have a place in heaven through all eternity. Let us hold to the things on which there is the stamp of immortality. Nothing else is worthy of human endeavor.

I cannot conceive of a single barrier in heaven. I know that the poetry of the Bible speaks of walls and gates, but this is simply an old-time picture of an Oriental city whose inhabitants are safe and happy forevermore. The gates of heaven, we shall find if we come nigh to them, are not shut; nor does St. Peter stand there with great keys in his hand. There are no barriers to keep souls out of heaven. The reason that sin and darkness and unhappiness and sorrow and tears are not found there is because these things would be unhappy there if they entered; and so they remain away.

If sin does not find peace and happiness in holy places and paths, and so seek them out in this life, neither will it do so in other spheres. The man who stays out of heaven shuts himself out. God shuts no man out. No man has a right to expect that any soul that does not seek heaven on earth will seek heaven on the other shore.

XLIII

BRIDGING CHASMS

HEREIN lies the difference between animals with wings and those without: It is simply a matter of bridges. What use has a bird for a bridge? But for you and me, bridges are a necessity. The English lark on easy wing, soars on high and into heaven, while you and I would need Jacob's ladder! Our own Southern buzzard, miles high, seems to touch, in his dreamy course, towering cloud bank after cloud bank, while you and I would need up there all the bridges of the land to compass them. I have stood on mountain-tops three miles high, and trembled as I looked over the brink into abysmal depths below; while a little bird from near me, flying out into mid-air and regardless of the chasm underneath, there gamboled and played. How humanity has envied the bird for her wings! How science has planned and schemed to imitate them! But up to to-day when we have wanted "a way across the impassable"—and this is what a bridge is—we have had to build a bridge.

There is a fascination about all bridges. No man could walk across Brooklyn bridge, or ride across the high bridge over the Cincinnati Southern Railroad in Kentucky, or the long bridge over

the Danube in Central Europe, or scale the aërial bridges in the Alps, without feeling at such time an exaltation that well-nigh lifts him out of the human sphere, and shall I say, into the life of wings? The greatest civil engineering feats of the world have been in bridging chasms. The engineer, in the interest of travel and commerce, in order to build his highways in mid-air, has had to call to his aid the strongest of woods and metal and stones, and also every cable and truss and girder and device known to science.

In reality the bridge builder is one of the master workmen of the world. His bridges join together things separated. His bridges fill chasms. His bridges transform the impassable into safe and easy highways. A bridge needs by no means be made of steel, nor be as complicated as the suspension bridge over Niagara, in order to be useful. A pontoon bridge, simple as it is—planks laid across a series of parallel boats—and so quickly made, and lacking in all the elements of cost—yet a pontoon bridge may carry an army in a few hours across an impassable river, and so save a country!

Nature unwittingly sometimes makes interesting bridges. Natural Bridge in Virginia is one of the world's wonders. And a tree, fallen across an impassable stream or bog, makes always a natural

bridge that coons and foxes and opossums and rabbits and dogs and hunters praise without stint. Squirrels get safely away from hunters—as we have often found out—by using the long limbs of trees as a bridge and by springing from the tip end of one over to the tip end of another. By this means they travel as fast upon the trees as you can on the ground.

A bridge, as we have seen, may be simply an arm outstretched like the squirrel's limb of the tree, or it may be a passageway held up by supporting pillars or by under- or over-head trusses, or it may be swung from lofty pillars at the termini, or it may be a solid embankment of earth built by a railroad across a ravine, or it may be simply a half-rotten log thrown down as unfit long ago in the forest by the storm. Nothing is too lowly or too mean to serve as a bridge, and nothing is too costly and grand!

How fast the world is conquering all of her chasms! Things that have stood separate and apart for centuries are daily being united and joined. The bridge is the symbol of science, civilization, and of union.

It's worth going to the Rigi to see how mountain peaks can stand innumerable all about you and no one touch another. How tall and straight

and individual they stand and with tops so keen and sharp!

But between them there lie as deep chasms as the world affords, and as impassable. Science and civilization have built no bridges just here. Now perchance if you stand on the slightest eminence and look down upon human groups, the individuals must appear in just some such way as this—perpendicular, rigid, and with frigid heads high in the air, and with chasms quite deep and unbridged between each one. The man who builds a bridge between such men is doing a moral and a scientific act. He is aiding in the unifying of humanity, as God and angels and redeemed stand unified in heaven.

And the man who causes his fellows to stand farther apart, and who thereby widens and amplifies the world's chasms, is certainly not a friend of humanity or a friend of God. Separation and isolation for individual or nation—what greater evil could happen to them! Who shall build bridges between mighty nations, and so be crowned with undying laurel by angels in the highest place?

I have seen railroad engineers build bridges across ravines, and then fill up the space beneath and to the bridges level with stone and earth and debris. Heaven send us men who will not only build bridges between nations, but will also fill up

the intervening void with bullets and shell and shrapnel and Krupp guns and Gatling guns and Mausers, Krag-Jorgensens and Winchesters and Martini-Henrys and Remingtons and assegai and machetes! In all of earth there is no material half so fine for filling in chasms as are these.

The impassable of yesterday will be the highway of to-morrow! The world, before it ends, is going to bridge and fill in all of its chasms. And heaven and hell? The bridge between them can be built whenever hell in man wants it. I do not say that the mere desire to escape consequent and righteous suffering will ever build this bridge. Bridges to heaven must be built from some other motive than that.

XLIV

IS IT A CLOD?

UT in the country if an indictment could be made out against "clods," and if the case should be committed to a jury, would not many a jury render decisions to the effect that clods are simply masses of earth, ugly, uncouth, inert, clumsy, useless, and valueless? And would not in truth the same jury return similar verdicts in the case of many other concomitant

things of country life? And viewed externally and superficially, perhaps they are. But on the other hand, if God has crammed his golden secrets into clods and rock and bushes and other material things that he has made, and keeps them there till men shall find them out, does it not imply that he must have laid an obligation upon man that he should discover and reveal these hidden things that must be beautiful and useful because he made them?

The moment that a man's profession—his real life-work—becomes a humdrum thing whose sole object is the possession of bread, meat, and clothing, at that same moment does every instrument in his hands for the accomplishment of his work, become dull and wearisome. It is not strange, then, that country life should so often be flat and unlovely. For it is too frequently the case that the men whose work leads them afield, have never delved for beauty and for God's secrets, but for bread only.

"As a man thinketh so is he"; and whatever thought and conception a country dweller may have of his environment, that environment and all of its constituents, assume actual forms and shapes that are high or low, according as is the mind of the thinker. Swedenborg found out that the act of breathing-in or in-spiration which is the expan-

sion of the human frame, was dependent upon thought and emotions, and that there was a fixed ratio between the two. And in the self-same way, nature about us expands and deepens in the ratio of our thoughts concerning it.

Our thoughts of things depend largely upon our relative standing-points. A chemist looking upon a clod, sees a complex assortment of forceful gases and salts. A mineralogist looking at a clod sees in it many shining and bright faces of valuable minerals. A botanist looking at a clod sees the fair and sweet faces of lilies and roses and carnations peeping out of its elements. And to all of these the clod is a thing of beauty, and both the man and the clod are lifted upon higher planes and into finer life. But we cannot lift up the things about us without first endowing them with life. The more analytical and the finer our minds become the greater will be that host that will rise up from the dead and stand round about us in glorified raiment.

See all you can in nature. Believe always more than you know. Unstop your ears of earthen clay so that you may hear all of nature's calls. Go into her fields, where on every mile there is spread out a million million miracles, in the same spirit which the Christ had as he stood over the grave of Lazarus and said "Come forth!"

A man can be poor and yet have high thoughts. A man can plough furrows and yet turn up only glorified clods, or going to and from his work, see bushes that are all afire with God. Struggle that you may not have the dullard's thoughts. Whether all the life that is under me, inanimate (so named) plant or animal, is immortal, I do not know, but there are those who believe that it is. Then the thought of yours or mine that ennobles them likewise ennobles us. And the thought of mine that fills them with life immortal, fills me also with self-same quality of life. We cannot endow the things about us with too much and too great life and glory and power.

It is worth a man's life to put life into a thing that once seemed dead and lifeless!

But suppose that God's thoughts of men are that they are living men—aye, more, that they are immortal men: then, because he thinks us living and immortal and because his thought actually fills us with these qualities, God himself is thereby exalted, and we do in very truth "glorify him."

The moment that we empty life or self, and in our thoughts and emotions get clear conceptions of what God intended it to be—the moment that we endow this mortal life of ours with immortality and grandeur of destiny, and conceive it to be

filled with noblest works and aims, then we not only lend splendor to this life, but our souls are raised. And the man who thinks upon life as simply the instrument for mortal pleasure and short-lived material gain, not only sinks life to lowest level, but debases his own mind and spirit.

That man of all his fellows who ascribes most glory and honor to God thereby lifts himself up to be a Saul in Israel. That man who most glorifies the origin, mission, and destiny of the human race, thereby places himself upon a corresponding higher level. And that man who has conceptions and thoughts of heaven—conceptions that make heaven mean more to him than a home of jasper walls and golden streets for those who shall enjoy therein eternally refined ease and rest—that man already is in heaven; and there awaits him in the by and by simply a perfected form of what now is.

XLV

SOLVENTS

SCIENCE being an exact thing, does not admit of ambiguity. If, therefore, you would speak exactly and scientifically, you should never use the verb "to melt." Put a bit of lead into the fire or pig iron into a heated

furnace, and they will, in ordinary language, "melt." A lump of sugar or salt dropped into a glass of cold or other water will also melt. These two sets of bodies it is true both go into a liquid state, but the causes of this fluidity are in no wise related or connected. Certainly therefore these differing and unrelated processes should not be designated by the same term.

Heat, as we know, will convert inorganic substances into a fluid state; the earth in its entirety was at one time, through heat, in this fluid condition. In such cases heat is the sole and only cause, and the process is "exactly" described as that of "fusion." Place sugar in water and the sugar, "exactly" speaking, "dissolves." We therefore speak of water as a "solvent" for sugar; but as to why, in sugar's case, water is a solvent when it is not a solvent for a hundred other and seemingly similar things, the wisest chemist, in truth, knows no more than yourself. As a matter of fact, it seems astounding, even to the point of absurdity, that science should be so helplessly and totally ignorant concerning this which is the commonest matter of every-day life; and that this simple phenomenon should have causes that as yet lie far back in God's hidden mysteries.

A solvent is a liquid which, when brought in contact with a solid, liquid, or gas, causes it to dis-

appear, the result being a clear, homogeneous fluid. As regards solubility, each substance that dissolves is a law unto itself. Some are dissolved in certain liquids, while they are unaffected by others. In a given quantity of liquid, some are only partially dissolved (this point in the solvent being known as the saturation point), while others are wholly dissolved. The heating of our solvent increases, in the case of some substances, their solubility, though the ratio of this increase may not be the same as the ratio of heat increase. In some cases the colder the solvent the greater the solubility. Common table salt, on the contrary, dissolves approximately equally at all temperatures. Let me add just here that a compound substance to be dissolved must be in many cases placed consecutively in its several solvents.

Of all solvents, water is the greatest. But water is not a universal solvent. A great host of metals, and rocks, the resins, many salts, and some of the active medical principles to be extracted from macerated plants, are not soluble in water. And while water approaches nearest to universality as a solvent, yet water itself is not antiseptic and does not "keep," and therefore we cannot preserve dissolved elements in water. Alcohol is the great antiseptic solvent. Most vegetable principles and fiber are extracted by it and after extrac-

tion are preserved in and by it. These liquid preparations are known as wines, spirits, tinctures, and fluid extracts. Alcohol is also a solvent for resins, and is used in their preparations for commercial uses; shellac varnish, for example, being simply gum shellac dissolved in alcohol. Ether, as a solvent, is mostly used to extract the oleo-resinous principles from organic drugs.

A solvent can itself be dissolved, or it can be immiscible, by another solvent. Glycerine, a solvent, is soluble in water and ether. Glycerine readily dissolves and holds in solution starch, albumen, pepsin, and vegetable acids. Chloroform (immiscible) is one of the most useful of all solvents in drug assay. Benzine is the more specifically a solvent for all oil and fatty substances. Carbon disulphide has a strange and peculiar range of solvent work, being used mostly in the dissolving of India rubber, iodine, phosphorus, and sulphur. Besides the above, certain acid waters and alkaline waters are largely used for solvent purposes. Of all solvents there is no more notable work done than by those solvents in your stomach that in the process of digestion dissolve into a clear homogeneous fluid the life-giving elements of your food, which are thus rendered ready for assimilation by your body, and which are for the maintenance of your life.

Each individual man, collectively and also as to his many-sided nature, like each individual element as regards solvents, is a law to himself. A thing may appeal to you that may not appeal to me, and a hundred things may not appeal to either. The things that appeal to us are those, to use the common term, that we "melt" into or that we are dissolved by; they are things that our being immersed in causes us to lose more or less our identity. Music, beauty, the mysteries of science, paintings, statuary, oratory, travel, the pursuit of wealth, are all of them solvents of some portion of many natures. But, however evident these things are in daily life, science cannot explain them.

Science cannot explain why music dissolves me and not you, or why it should dissolve either of us. Men daily influence their fellows in proportion as they possess within themselves the necessary solvents and know when and how to use them. You could have all of this human world at your feet if you only held humanity's universal solvent and could only gain humanity's universal attention. Science has not as yet given us a universal solvent in the physical world; but this one thing lacking, God in very truth has given in his higher realms. In these realms, his universal solvent is love. And love is beautiful, not only because it is a solvent, but also because this solvent

is antiseptic. That which is dissolved in love will be kept and preserved forever and beyond!

That God has not as yet all of humanity at his feet is not because he does not hold in his hand that universal solvent which is the greatest thing in the world and the greatest thing in heaven; but it is because he has not as yet gained the world's thought and attention. And this is why, since God holds this great solvent, the dominant notes in all the Scriptures are "Hear" and "Hearken."

XLVI

CHEMICAL REAGENTS

THE human eye is perhaps man's greatest source of discovery, the other senses following in their order. The microscope on one hand, and the telescope on the other, are only methods of multiplying the strength of capacity of the eye hundreds or thousands of times. But if you were to fill a beaker with common atmospheric air, or sewer gas, or if you were to dip up a goblet full of water from some mineral spring, or if you were to throw into a tin pail a spade full of any soil whatsoever, then even though the eyes and all the other senses of all the human beings on earth were turned thereon, the world would be

as ignorant of the contents—salts, acids, alkalies, and minerals, called chemical constituents—of these receptacles as it would be if the world were actually bereft of sight, hearing, feeling, taste, and smell. There is only one way of finding out secrets such as these, and this is by means of that earthly divinity known among the sciences as chemistry.

Chemistry makes her discoveries by means of what are known as reagents. An agent, as we all know, is one who acts. A reagent on the other hand, exerts a reflex action. A reagent is a substance used to effect a chemical change in another substance for identifying its component parts, or getting at percentage of composition. Of course, to find the component parts in a multifarious compound, many reagents, and at different times, would be necessary. If your change produced through a reagent leads you to recognize your ingredients, you have found, then, what is known as a "test" for this ingredient. If a farmer believes that his spring or well of water has iron in it, he simply has to add to a glass of it a bit of nutgall. If at the bottom of the glass is then precipitated (called a precipitation test) a dark purplish substance, then he has identified iron as being in this water, because nutgall is a test for iron. If your doctor tells you to avoid starch and

to live on gluten bread, and if you wish to test your bread for starch, you have only to drop a few drops of solution of iodine on a few crumbs; and then if these crumbs turn blue (called color test) your bread is not pure gluten, but partly starch. Iodine as a reagent is known as an infallible test for starch, since nothing else in this manner colors starch blue.

A chemical reagent will cause certain reaction when, as I believe, all other earthly causes would totally fail. If, for example, you wish to test for ammonia in water, then add a few drops of strong alkaline solution of potassium iodide and mercuric chloride to a few ounces of the suspected water; the latter will immediately show, through and through, a reddish yellow tinge, even though there be in our solution only one part of ammonia to twenty million parts of water!

All of the thousand tints of autumn leaves, we know, are chemical reactions caused by certain reagents; but we are in profound ignorance as to the what and the how of it. How delicately must all things hang in balances, since we see how easily greatest changes occur! How multitudinous on the other hand must be all the reagents ("tests") as used by nature! There is one for the yellow in poplar, and other reagents still for the varying maroon shades of sweet gum, oak, and dogwood.

And back, indeed, of each and every one of all the myriads of autumn tints you can see, as it were, a master chemist with a host of reagents testing this and that and yonder thing!

I do not doubt but that God has filled the moral world with as many reagents, and as potent, as he has given the physical. Armed as you and I are with them, and oftentimes and all unconsciously, perhaps, letting them fall drop by drop here and yonder as we move among our fellow-men and brothers, how delicately and circumspectly should we always go!

I have seen one little reagent word change a man into a demon of fury, and I have seen one single word change a tumultuous multitude into one of calm and quiet. After seeing, under the proper reagent test, a goblet of clear water turned into that of reddish yellow tinge, even though there were present only one part of ammonia to twenty million parts of purest and clearest water—after seeing this, I am not surprised at the continued changes that I see in the men and women about me.

Not infrequently, in chemical changes that are produced, the reagents combine with the thing tested for—the reaction in this case being somewhat of a dual rather than a simple and single nature. Perhaps it is this dual and more glorious

reaction that fills in October the forests with their many and marvelous autumn tints. And in some such way the substance or reagent or test out of heaven combining with the moral quality tested for in the human and earthly—in some such way I have often thought (since God must daily test the hearts of his children to find perchance the various goodnesses) that I had discovered the cause of the many beautiful reactions as seen in the lives and manners of men and women. And true it would be, if every human being only had in him those many moral qualities that God is consecutively, perhaps, and daily testing for, then the reaction resulting therefrom would show beyond all peradventure, to eyes on earth and in heaven, far more of glory and brilliancy than even do all the combined October forests of earth!

XLVII

LOST MOTION

HAVE often stood on the banks of a river —a stream made only for onward flowing, and toward which end all of its energies should be conserved and spent—and have noted mid-stream, and in the shallows by the banks, whirlpools and eddies that for the most part re-

mained stationary and that simply turned rapidly about in circles upon their axes. Their place might be marked by a roar of waters and by foam which is the wrath of waters, but even if there were no noise, there would always be seen whirling bits of wreckage and of varied *débris* that had been caught and so held fast. These rotary eddies are, in a sense, the wasted energies of the river; and in truth there is not a Charybdis, small or great, in all waters of seas or rivers, that does not to man and craft mean danger and perhaps destruction.

In some such way there is not a moving thing on earth, or an engine of force or motive power, in which there is not more or less deviation, or slack, or eccentric, that produces lost motion and that wastes energy and vitality. I can at this moment think of no skill that needs to be reduced to such refinement of nicety as is that which is required in making and fitting the engine rods of a locomotive or stationary engine.

It is said that a slack of one-sixteenth of an inch will destroy an engine in twenty-four hours; while a slack of one one-hundred-thousandth of an inch, is plainly discernible.

It is the worn gearing, and loose nuts and bolts, the portions that are out of plumb and line and center, the parts unscientifically made and fitted,

and the unlubricated places, that make machinery, the world over, wobble and reel like a human being who is drunk. You never felt in your life a jar or "jolt" or jostle, but that it surely indicated lost force and wasted energy. And every jolt means wear and tear of machinery, as well as nervous tissue on the part of the human sufferer. It is pain in the human world that quickly tells us of some injury to ourselves; and so likewise in the physical world, it is rattle or roar, and the thousand other noises—machinery's cry of pain—that quickly tell of loss and injury to engine or other vehicle in motion. Have you ever noticed a long, loosely coupled freight train move off or come to a stop, and then in comparison watched a solidly built vestibule train? Did you ever work the handle of a water pump and feel in your very finger nerves the loss and waste? Have you ever ridden in a wagon to which the horse carelessly or ignorantly had been loosely harnessed?

Misdirected energy is another potent form of energy that is wasted and force that is lost. Ignorance, as well as knowledge, is always trying to accomplish some object or to go somewhere. Read the list of follies that ignorance has placed in the patent office in Washington! What a vast amount of energy has been consumed and wasted upon perpetual motion alone!

There is such a thing as the wrong thing initially and throughout, and there is too, a right thing wrongly carried out. Ignorance may be counted upon as being the friend of both. Wherever ignorance goes, she absolutely blocks the way behind her with wreckage. Count and foot up your annual billions of losses that ignorance causes—buildings wrongly constructed, badly insulated electric wiring, ignorant firing and watering of engines, the improper tillage of land, the imperfect conservation of water, the unscientific building of dams, rough and improper road making, food improperly cooked, the ignorant administering of drugs by the physician, or the butchering of the human being by the surgeon! And the worst of it all is that energy wasted is motion lost forever. For who can recover and so gain again the energy spent and wasted on yesterday!

The world would have been redeemed long ago and the millennium of a new earth would have come if only the energies of past generations had been rightly impelled and directed. And there would in this day and generation be as speedy a redemption of the world, if only the religion of Christ were given free course on earth and if it were not impeded and hindered by energy wasted and motion lost.

The church of Christ could to-day do anything under high heaven that pleased it, if only its forces were rightly placed, conserved, and carried forward. In all the universe there is nothing more able and powerful than righteousness; and when rightly directed, there is nothing that could withstand it!

But the church cannot be better than its individual members. And all of these members, in truth, have their counterparts down in the physical world in the various parts of earth's enginery and vehicle or method of motion. The law of one kingdom must always be the law of another kingdom. We do not wonder at all the material cries of pain of machinery, and damage to and loss of machinery, when we see worn gearing, and loose nuts, and universal slack in every part. We do not wonder at jars and jolts and jostle, when we see rude tracks and roadways. Nor would our minds fill with slightest wonder if a city's river that spent all of its energies upon loitering eddies should never reach the sea!

How can a church go forward that is full of rust-eaten members; members ever pulling on the back strap; members that are ever pirouetting about themselves; members that show, in all that they do, grievous exhibition of general slack. Remember that one one-hundred-thousandth of an

inch of slack in an engine rod would in no great while wear out the engine!

No waste, no loss in highest heaven; then in heaven, what an exhibition must there be of conserved energy? The human mind fails in imagination and thought of what may be accomplished and done in that wondrous land by redeemed, angels, and God!

XLVIII

RESISTANCE

THE most beautiful of all zigzag courses, looking like fiery steps leading from earth to heaven, is the path of the lightning through the skies. As thin and easy of penetration as is air, yet even air can swerve and turn aside and make as crooked as a mountain path Jove's titanic fiery thunderbolts!

That we do not take largely into account the resistance of air is shown by the shapes—square and with high front—of all our carrying vehicles, such as cars and wagons. The patterns of all of these, so far as speed is concerned, and so far as concerns kindliness to all animals that draw them, are a slur upon human intelligence and a shame upon our humanities. And certain it is that the

shapes of these must soon change, now that the demand for greater speed is so great and pressing. I do not doubt but that the railroad express train of the future will be cigar-shaped and sheathed in from cow-catcher to rear platform ; and that all of our lesser vehicles will be built with an eye to the lessening of air resistance.

If our ship-builders were to build ships after the pattern of a wagon, our trans-Atlantic companies would need fifty in place of five days for the passage to Liverpool. The pattern of a ship affords to date the ideal for quick transit. The ball and shell of the modern rifle fired in the air, the ascending balloon, the fish in the water, and the flying bird, as well as all sharp-edged tools for cutting—these all conform as far as possible to the type of a boat or hull of a ship. On account of the denser medium, the sharp-nosed ship, however, cannot go more than one-third as fast as the more blunt railroad train.

There is not a thing that moves in earth, sky, or water, be it animal, light, heat, electricity, water, or wind, that does not meet with resistance. Resistance is the most universal force found in all matter in nature. It is a component part indeed of all matter. Nor can you by any means disseminate matter into a state of such distention and thinness that all resistance will be lost. Resist-

ance therefore must ever remain a desideratum and drawback which material matter can never rid itself of.

Now it is possible practically to rid a given area of matter. We call that state a vacuum—a place without hindrance. The most beautiful experiments in physics are made with electricity and light. In commerce, since the boiling point of water in a vacuum is much less than in open air, a vacuum affords us a means for largely reducing certain costs. The great industry of salt making, for example, would be a far more costly affair if it were not for the fact that the water in brine can be evaporated (and thus leave salt) in large vacuum pans at a low temperature in place of a high temperature. Cargoes of moist grain can be put into a vacuum pan and give off their moisture at a low and cheaply produced temperature. Drying in vacuum is said to take one-tenth less of the steam and of the time and of the space than does hot-air drying. Indeed, the uses of vacuum pans are just becoming well known and they promise in the future the greatest results.

If it were possible to create for electricity's travel a condition similar to the vacuum, what an easy solution would that be of power transmission? If Niagara's power, costing a trifle, without loss could be converted into electricity and carried to

Chicago or San Francisco, then the world would have no more use for coal, for heat, power, or artificial light. But for electricity, copper and silver wire offer the least resistance known at present, and this resistance increases so greatly and so rapidly, according to distance, that for distant power along this line no great work is being done.

In the higher realms of mind and spirit, we have the same resisting media, and the same general lack of conformity to all of those patterns or laws that make for ease of progress in any given line. A whole nation, for example, can stand out for centuries against civilization, Christianity, or the higher learning.

The most pitiful thing in human life, I believe, is an ignorant man. Enlightenment stands in the same relationship to him as does the ray of sunshine that falls upon a brick wall, both being impenetrable media. And the saddest thing in this world is the immoral man. The light of heaven falls upon many such for three score and ten years, and never once gains entrance.

God and Christ and angel have not shut themselves up in a fancied city's wall, and without communication, and so left earth and man to work out their own salvation. God is as actively at work in earth to-day as ever he was—and angels too!

Heaven works through men. Men are God's intermediaries or rather media. The degree of resistance depends ever upon the individual man. You can see the shimmering light of heaven shining through some people's faces, and in all of their deeds you see the Christ-man himself. A touch of their hand—and you feel an electric thrill from some dynamo higher than the stars!

To spiritualize your life means to rid it of the material, and the more you rid it of the material, the less resistance to the divine there must remain in you. If you could only find some spiritual air pump that would rid you of the earthy, if God could only work in and through you in earthly vacuum, how quickly the kingdom of heaven would come!

XLIX

NATURE'S VARIED STANDPOINTS

EACH square foot on this earth's surface, represents a different and a new physical standpoint for man's use. Far more numerous, but not so tangible, are those other standpoints absolutely unthinkable in number, to be found within the earth and within the still greater sea and within the still greater enveloping

atmosphere. Each of these myriad standpoints represents a new outlook, or a new point of view with a different environment.

Now even as regards contiguous and related standpoints, go if you please from any one of them one step forward, or indeed in any other possible direction, and it would mean for you that some objects hitherto lost would come into view, and still others would grow more distinct and clear.

To gain new outlooks attained by the seeking out of new standpoints, is the sole object of travel. The provincial man must ever have his limitations and must remain narrow, contracted, prejudiced, biased, and uncosmopolitan. No man can ever be said to know this earth until he has seen it from its every viewpoint. The explorer, therefore, is deserving among his fellows of the highest places; kings and scientific societies and national commercial unions take delight in the honoring of him.

Viewpoints vary largely in value, according to their relative elevation or altitude, and according to clearness of surrounding media, and according to the relative richness of contiguous environment. There is perhaps on a clear day, in all of earth, no nobler and more beautiful view than is to be had from the Rigi in Switzerland. Compare now, if you will, in point of value, Rigi's outlook with that

to be had at the bottom of cañon or pit, or that in the depths of the sea, or in mines of earth, or in mid-Sahara.

To everything that hath eyes to see, God has given the powers of locomotion, and for these he has spread out a wondrous and beautiful and diversified world—a world, as I have said, with myriad outlooks and views. I would have pity even for a bird that, with wounded wing, could never go farther than her nest; infinitely do I pity the man who, through poverty or indifference, has never made some exploration of God's great world. And glad I am, because we have these capacities for locomotion, that you and I and all animal life are not bound unwillingly down to a given habitat.

In all the kingdoms, each standpoint affords us a new view and a new outlook, and gives us by this a much more comprehensive knowledge of the total object under observation. There is not a subject in earth or heaven, that men or angels can ever thoroughly know until they have stood upon every square foot of it and scanned its environing landscape to its own horizon line. To gain daily new outlooks by planting feet on new standpoints is the habit of the wise. Culture comes only in this way. The man who persists in standing ever in his own tracks, or goes back and plants himself

immovable in the tracks of his fathers, needs mankind's immeasurable pity.

I care not whether our every subject be of science or art, or whether it be a matter of profoundest morals, yet we may know, since God made it, that in its length and breadth and height and depth, there are myriads of viewpoints of observation and study and knowledge concerning it. The man who has thought and studied and toiled and prayed only for a day, has just entered upon the threshold of knowledge, and is apt, like the man who has never traveled a hundred miles from home, to be narrow, contracted, prejudiced, biased, and provincial. And however strange it may seem, yet it is surely true, that any man, be he in pulpit or pew, or wherever else you may please, if he possess but few points of view, will be by that much the more dogmatic. In matters of religion, a sect is a mere thing of dogmatism; while a church—exploring all the continents of earth to save a man—is the most comprehensive and all-loving force on earth.

Possibly the man who has least patience and sympathy with mankind, is he who knows the least about men. Herein lies the cause of God's great sympathy, love and helpfulness toward human kind. He sees us from viewpoints that you and I can only dream of. He sees us from the view-

points of infinite capacity for knowledge and happiness, and infinite possibilities of the highest and holiest kinds; and because from these viewpoints he sees these possibilities in us, he suffers long with us and he lends us too, continually, so far as we will allow him, his own powerful inspiration and aid. And certain it is, wherever men look upon man as God looks upon him, such men will always be the world's sympathizers, the world's helpers, and the world's saviours!

I know of no point of view that looks out upon so fair a view as is afforded by the viewpoint of a Christian optimist. Cynicism, agnosticism, and disbelief should have no place in God's world. I have faith in a continual upward trend. There shall be a new earth, there shall be a new heaven, and there shall be a new man! I cannot say how long it will take to lift humanity in its entirety out of the pit, a pit without outlook upon beauteous vision, but I must believe that this consummation at some point in the beyond must surely come.

If it were possible for you and me and all men to view sin and selfishness and unbelief and materialism, as God, from his standpoint or point of view, sees them, then man's redemption would proceed at infinite speed! If from your viewpoint, materialism, and unbelief, and all forms of sin, do not appear to be the most horrid things in earth,

then fly as for your life to some plane with clearer and higher outlook!

L

HARMONY

IT is by combining sounds of different pitch that the composer writes music—it may be a waltz, a lullaby, a march, or an oratorio. A modern musician can in one single composition combine every sentiment that the human being is capable of, from the grave to the gay, or from the despairing to the triumphant.

Modern music is thus largely descriptive. Composition that consecutively describes such conflicting emotional conditions, must necessarily be complex. Aside from this, our first thought is that these rapid dissonant changes would be naught but discords; but our musician by rapid modulations can change, without jar upon your ear, a minor into a major, or a major into a minor, and in a twinkling convert a wail of despair into a pæan of hope! The musician in truth can combine and can correlate and bring into mutual relations, things most dissimilar, unrelated, and seemingly opposed. The musician in a sense can make a corral out of the universe and correlate not only

the things of earth, but bind planet to star and star to constellation.

Through the use of common chords, the musician, by bringing into mutual relationship things unrelated, separate, and apart, unifies in a manner all the things of his kingdom and is a prince among the synthesists. To do this requires oftentimes what is known as close harmony; but to the refined musical ear, the closer the harmony the more exquisite the delight.

A child with his forefinger can pick out note by note, in a limited way, a simple melodious exercise. The musician by the practical combination of chords, with both hands and by the use of many octaves in his instrument, can elaborate his harmony and make tones and progressions unthought of by the child. The history of harmony is the history of ever-increasing richness of combinations of common chords. All rules of harmony are constantly being modified. Many chord formations and voice progressions wholly unpermissible at one time, are to-day in current use by the masters. The elaboration of harmony has required centuries of labor and thought.

There are possible infinite arrangement and rearrangement of harmonious material, and infinite combinations of related parts—each one æsthetically pleasing. There thus can be no end to har-

monious composition. The perfection of harmony possibly is found in the large orchestra, scores of the instruments of which have differing notes, differing chords, and differing quality of sound. All of this variety wonderfully enriches the melody.

While the music of the past has been largely arbitrary, the structure of harmony in the future seems to have possibly no limitations. There will ever be, in harmony, a lessening of distance or ratio as between notes, a finer gradation, a continuous larger use of tones foreign to the original key, and progressively a still more glorious joining and combination and correlation of notes.

All modulations require a return to the original keynote before the end of the musical composition; but in the meanwhile the player may have brought into harmonious use every note of his instrument. No less restricted than our musician is the inventor of harmonies in the moral world, who joins, combines, correlates, and brings into mutual relationship, those who are separate, apart, and seemingly unrelated. The keynote of your neighbor may be different from and foreign to your own. But there are happily such things as modulation, gradation, and progression. To compass the end may require close harmony, yet it is harmony perhaps all the more beautiful.

In the harmonious material that lies between yourself and the world, and between God and the world, there is possible infinite arrangement and re-arrangement. In the moral world, also, there can thus be no end to harmonious composition. God's thought for the world is that it may be a mighty orchestra, antiphonal to the orchestra of heaven.

The coming of Christ means the unification of the world, I in you, you in me, and God in and for us all! In this re-arrangement no man can live to himself or by himself. No matter how far away and lost he may be, you can reach him—by modulations, remembering, however, that the rules thereto are not arbitrary.

The need of us all is to get a finer sense of quality. The quality of the bassoon, violin, cornet, and trombone—they all widely differ; but in place of making orchestral discords, they vastly enrich the melody.

Pythagoras said that the seven planets were the seven notes of the octave, and all the heavenly bodies were a part of an universal orchestra; not one, thought he,

> But that in its motion like an angel sings.

In the highest sense I doubt not the truth of this, nor do I doubt also the universal brotherhood

to be—just so soon as we correlate ourselves, the one with the other and with the angels and with God! This we can do through Jesus Christ alone. He is the keynote of the universe. In him alone can all things be one,—one in harmony and one in eternal purpose.

JAN 5 1903

Deacidified using the Bookkeeper process.
Neutralizing agent: Magnesium Oxide
Treatment Date: Dec. 2004

PreservationTechnologies
A WORLD LEADER IN PAPER PRESERVATION
111 Thomson Park Drive
Cranberry Township, PA 16066
(724) 779-2111

LIBRARY OF CONGRESS
0 013 653 599 7